

**OPTOCOMP**  
**SERIES of LUMINOMETERS**  
**SERVICE MANUAL**

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## ***SAFETY SYMBOLS***

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The lightning flash with arrowhead within a triangle is intended to tell the user that parts inside the product are a risk of electrical shock to persons.



The exclamation point within a triangle is intended to the user to the presence of important operation and (servicing) instructions in the literature accompanying the device.

**CAUTION:** Disconnect power cord before removing cover. See user's manual prior to servicing.

## INTRODUCTION

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The OPTOCOMP™ I and II Luminometers are stand-alone, photon counting instruments used in measuring light emitted from bio- or chemiluminescent reactions. The major difference between the two instruments is that the sample tubes are hand loaded one at a time into the OPTOCOMP I, while the OPTOCOMP II can process 250 samples automatically in sequence.

The emitted photons are detected by a photomultiplier tube (PMT) and converted into electrical pulses. The photon pulses counted are directly proportional to the amount of light emitted by the reaction are displayed as Relative Light Units (RLU). The resulting RLU are stored in memory for further data reduction and may be printed out for a permanent record.

A measuring sequence is initiated by selecting a protocol, inserting the sample tube(s) into the counting chamber and closing the lid. The OPTOCOMP II will automatically move the tubes into the counting position. An internal computer controls any injections, counts the RLU, analyzes the data and displays and prints the results.

Up to 30 protocols may be programmed, stored in non-volatile memory, and recalled at any time to run a test. Programmable parameters include:

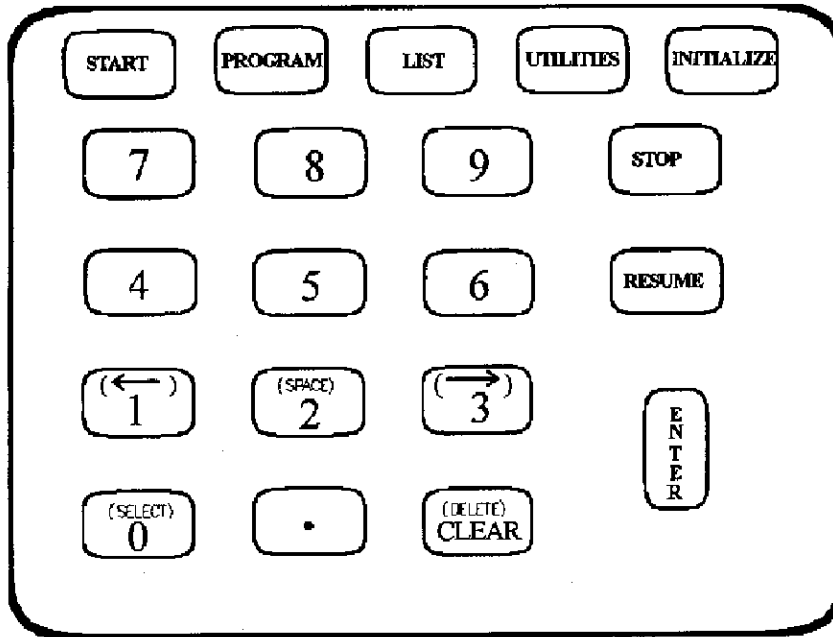
* Type of test	Cutoff, LIA, Kinetic. Raw Data
* Protocol name	Alphanumeric printout for positive test ID
* Injectors used	None, A only, B only, A then B
* Types of tubes	Number of replicates of References, Standards, Controls, and Sample tubes
* Count time	Programmable from 0.02 to 60 seconds
* Data reduction	Several different algorithms are available. Consult the Operator's manual

All data is printed on the built in thermal graphics printer. Kinetic study and LIA results may be plotted and the data displayed.

The RS-232 data communication port is b-directional and may be used to transmit results to, or receive control signals from an external computer. The OPTOCOMP may also be programmed from an external source.

## FRONT PANEL CONTROLS

---



**START**  
**PROGRAM**  
**LIST**  
**UTILITIES**  
**INITIALIZE**  
**RESUME**  
**STOP**  
**ENTER**

START a programmed protocol  
Edits protocol parameters  
Lists protocol parameters  
Calls the UTILITIES menu  
Primes injectors and injector lines  
RESUMES an interrupted protocol  
Interrupts a protocol  
Accepts a displayed value

Please consult the OPERATOR'S MANUAL instructions for programming and normal operation.

## THEORY OF OPERATION

The energy released as a result of the oxidation of certain luminescent molecules generates one or more photons of light. The OPTOCOMP Luminometers are able to detect these individual photons by means of a highly sensitive PHOTOMULTIPLIER TUBE (PMT).

Figure 1 is a schematic diagram of a photon counting PMT:

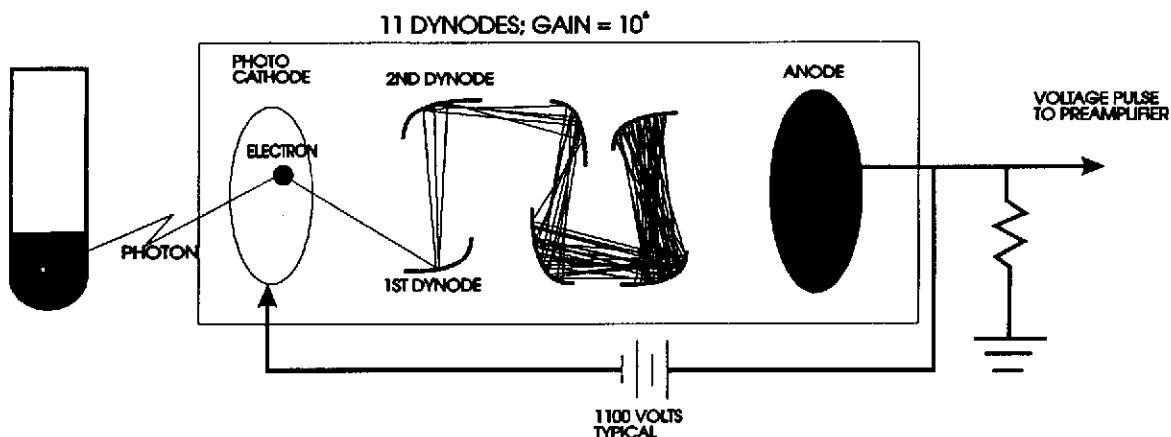


Figure 1: Photon counting photomultiplier tube

The photons generated in the sample tube are collected by the photocathode surface on the back of the PMT faceplate. This surface is formulated to generate free electrons in a vacuum environment and reaches maximum sensitivity in the spectral region of luminescence (blue).

The PMT consists of a series of dynodes each at a higher voltage. The negatively charged electrons are attracted to the higher potential of the next dynode. The voltage between the dynodes gives each electron sufficient energy to dislodge several additional electrons – the multiplication effect. At the end of the dynode string, nearly one million electrons have been generated by a single photon. The last electrode in the PMT, The anode, collects the current and conducts it to a resistor. A small voltage pulse is generated and is amplified by the preamplifier.

## PREAMPLIFIER

(Refer to the Preamplifier Schematic)

The voltage pulse is generated across resistor R2. Typically 1100 VDC is applied across the dynode resistor divider string R3 through R14. C5 is a high voltage 22pf capacitor that couples the pulse to the unity gain buffer amplifier U1. U1 presents a low impedance pulse source to inverting amplifier U2 in order to maintain a high slew rate without oscillation. The positive going pulse is fed through capacitor C17 to comparator U4. Potentiometer R28 sets the comparator threshold voltage, (Vth) for approximately 25mV. This value eliminates most stray noise yet is low enough to sense single photon events. The output of U4 is a TTL pulse of 15-40 nanoseconds which is carried via a coaxial cable to the main PCB.

## ***PMT SHUTTER ASSEMBLY***

Figure 2 is a schematic representation of the physical arrangement of the PMT, safety shutter and the shutter open and closed sensors. A bi-directional DC motor moves the shutter in front of the detection aperture whenever measurements are not being made. This prevents damage to the photocathode due to exposure to ambient light with the high voltage applied. Another safety measure is reduction of the high voltage when the shutter is closed.

When the lid is closed and a count sequence is initiated, the shutter motor moves the shutter to the open position. The shutter open sensor is activated when the shutter physically breaks the infra red beam of the sensor. At this point, the high voltage is restored, the injection sequence is activated (if programmed) and the measurement taken.

Current to the Shutter Motor is monitored and a stall message is displayed and the motor is turned off if excess current is drawn. (See SHUTTER STALL ERROR)

The computer also monitors shutter travel time and the shutter motor is turned off if the shutter sensors are not activated in a preset amount of time. (See SHUTTER DRIVE ERROR).

At the end of the count sequence, or whenever the LID OPEN button is pressed, the shutter is moved in front of the PMT. The SHUTTER CLOSED SENSOR assures that the shutter is fully closed before the lid is allowed to open.

## ***TYPES OF PROTOCOLS***

### **RAW DATA**

Timed counts programmable from 0.02 to 650 seconds. The mean value RLU and Coefficient of Variation (%CV) of up to 10 replicates is reported. Blank tube subtraction may be programmed using the mean value of up to 10 blank tube replicates. Either injector (A or B) or both, or none may be used with programmable delay timing.

### **KINETIC**

Up to 100 timed count intervals programmable from 0.02 to 650 seconds. The time delay between count intervals is also programmable from 0 to 3600 seconds. Results may be reported as RLU values, RLU vs. time, or both.

### **LUMINESCENT IMMUNOASSAY (LIA)**

Up to 10 Standard values may be entered used each with up to 10 replicates. Timed counts may be programmed from 0.02 to 650 seconds. The mean value, and %CV of up to 10 replicates is reported. A menu of data handling routines including Ratio, Point-to-Point, and Spline Smoothing as well as others.



**CUTOFF (Qualitative)**

Sample RLU are compared to a Sample Value times a Cutoff Factor. The reference may be either a Negative Reference, or a Positive Reference. Cutoff Factors are programmable. Results are reported as Positive, Negative, or Equivocal, relative to the Cutoff value(s). Complete programming flexibility is provided.

Operator safety has been a major consideration during the design and development of the OPTOCOMP I and OPTOCOMP II. With proper use and care, it will provide safe and reliable operation. Misuse, however, could result in either damage to the instrument or serious personal injury to the operator.

**CAUTION!**  
**DANGEROUS VOLTAGES EXIST INSIDE THE**  
**INSTRUMENT! USE CAUTION WHEN**  
**SERVICING**

This manual is intended for use by technical service personnel. Please read this manual thoroughly and familiarize yourself with the instrument before attempting to service it.

**Covers should be removed by qualified personnel only!**

## ***SPECIFICATIONS***

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Power requirements:	100 to 240 VAC, 50\60 Hz (selectable)
Sample size	12 x 75 mm for OPTOCOMP I and II 4 X 40 mm for OPTOCOMP IIM
Weight	OPTOCOMP I) Approximately 25 lb. (11.3 Kg)
	OPTOCOMP II Approximately 51 lb. (23 Kg)
Physical size:	OPTOCOMP I 18''w X 7''h X 15.5''d (45cm x 17cm x 39cm) OPTOCOMP II 18''w x 6''h x 26''d (45cm x 17cm x 67cm)
Spectral Response	300 – 600 nm
Background	<50 RLU/sec
Maximum Linear Count Rate	1x10 <sup>6</sup> RLU/Second
Computer Interface	RS-232 Serial (bi-directional)
Brown Out Protection	Automatically stores data during brown outs and power failures

## **UTILITIES**

---

The UTILITIES Menu contains parameters set by the user, as well as “hidden” parameters which are to be utilized by service personnel. The UTILITY functions that are operator accessible in the OPTOCOMP I are as follows;

1. **OPER(ATOR) NAME** allows the user to select one of 5 names to be printed on the results header.
2. **DATE/TIME** allows the user to adjust the internal clock-calendar
3. **Q/A** checks detector response and instrument background.
4. **BACKGROUND LIMIT** allows the user to set the maximum background luminescence prior to reagent injection. Programmable from 0 to 999.
5. **NEXT MENU** changes the display to selections 6 through 9.
6. **CAL FACTOR** allows the user to normalize the instrument response by applying a multiplication factor. Valid entries range from .063 to 2.0.
7. **COUNT DELAY** allows the user to select a delay time (in seconds) prior to initiation of a count sequence. Valid entries are 0 to 10 seconds.
8. **REPORT MODE** allows the user to select the on board printer or the RS-232 port for data output.
9. **FIRST MENU** returns the user to the first UTILITIES display (selections 1-5)

The OPTOCOMP II differs slightly in the UTILITIES MENU. It is as follows;

1. **OPERATOR NAME** same as OPTOCOMP I
2. **DATE/TIME**-same as OPTOCOMP I
3. **Q/A**-same as OPTOCOMP I
4. **MOVE CASSETTES** allows the user to position the cassettes using the internal motors of the instrument. “TAB INITIALIZE” is also performed using this function placing the cassette drive tabs in the home position.
5. **NEXT MENU** changes the display to selections 6 – 10.
6. **CAL FACTOR**-same as OPTOCOMP I

7. **BACKGROUND LIMIT**-same as OPTOCOMP I
8. **COUNT DELAY**-same as OPTOCOMP I
9. **REPORT MODE**-same as OPTOCOMP I
10. **FIRST MENU** returns user to the first five selections (1-5)

## ***SERVICES UTILITIES***

The “HIDDEN UTILITIES” are useful for troubleshooting and repairing the OPTOCOMP Luminometers. To access these utilities press UTILITIES, enter the number of the utility you wish to access, press **ENTER**. At this point the instrument will beep signaling an improper keystroke, press **RESUME** to display the utility. OPTOCOMP I hidden utilities are listed below.

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| * <b>SERIAL NUMBER (10)</b>        | * <b>PMT FACTOR (11)</b>          |
| * <b>INJECTOR TYPE (12)</b>        | * <b>SENSOR STATUS (13)</b>       |
| * <b>TWO POINT ADJUSTMENT (14)</b> | * <b>DISPLAY EDITED FLAG (15)</b> |

The HIDDEN UTILITIES for the OPTOCOMP II are listed below.

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| * <b>HIDDEN UTILITY MENU (11)</b>  | * <b>SERIAL NUMBER (12)</b>         |
| * <b>PMT FACTOR (13)</b>           | * <b>INJECTOR TYPE (14)</b>         |
| * <b>SENSOR STATUS (15)</b>        | * <b>TWO POINT CALIBRATION (16)</b> |
| * <b>DISPLAY EDITED FLAG (17)</b>  | * <b>TUBE TYPE (18)</b>             |
| * <b>DEFAULT DISPLAY NAME (19)</b> | * <b>DISPLAY OVERLOAD FLAG (20)</b> |

*HIDDEN UTILITY MENU*-Lists the numbers for the following choices (11-17)

*SERIAL NUMBER*- changes the serial number in the system memory. This number is printed on Q/A printouts as well as headers for all tests conducted on the instrument.

*PMT FACTOR*-Basically the same as the CALL FACTOR except it is not user selectable. This is a method of normalizing the photomultiplier tube.

*INJECTOR TYPE*-Sets the system up for either an MGM type injector or a VALCOR type injector. This adjusts the cycle time of the pulse sent to the injector by the CPU.  
**This should always be set to MGM.**

*SENSOR STATUS*-Gives a visible readout of the status of the sensors inside the instrument (see below).

*TWO POINT ADJUSTMENT*-Used with LIA software to illustrate an actual curve as well as an adjusted curve after two calibrators have been run. Typically set to zero reporting only the adjusted curve.

*DISPLAY EDITED FLAG*-Prints a flag to alert the user that the values printed were edited rather than actual.

*DEFAULT MAIN MENU NAME*-Allows the name on the main menu (default is OPTOCOMP) to be customized to the users company name or any name up to 16 characters.

*DISPLAY OVERLOAD FLAG*-Alerts the user to the fact that the maximum count rate has been exceeded in certain cases.

**EXAMPLE**

To access and change the PMT factor on an OPTOCOMP I, from the MAIN MENU press **UTILITIES**.

OPTOCOMP I                      SELECT:  
START PROGRAM LIST UTILITIES INITIALIZE

Press **1,1** followed by ENTER, and RESUME. The following will be displayed.

PMT FACTOR    1.06  
PRESS ENTER

To change the PMT factor simply enter the new PMT factor on the from panel keypad and press ENTER. The instrument will automatically return to Main Menu.

## SENSOR STATUS

```
SENSORS: LO=Y LC=N TP=Y SS=N SO=N SC=Y  
FUNCTIONS: 1=QS=Y 2=OS 3=CS 4=PSO 5=PSC
```

The first line indicates the status of the sensors on the instrument, the second line presents a list of test selections.

<b>LO:</b>	Lid Open, gives the status of the Lid Open Sensor
<b>LC</b>	Lid Closed, gives the status of the Lid Closed Sensor
<b>TP</b>	Tube Present, gives the status of the Tube Present Sensor
<b>SS</b>	Shutter Stall, tells whether a shutter stall has occurred during
<b>SO</b>	Shutter Open, gives the status of the Shutter Open Sensor
<b>SC</b>	Shutter Closed, gives the status of the Shutter Closed Sensor
<b>OS</b>	Open Shutter, opens the safety shutter
<b>CS</b>	Close Shutter, closes the safety shutter
<b>PSO</b>	Pulse Shutter Open, Opens the Safety Shutter incrementally
<b>PSC</b>	Pulse Shutter Closed, closes the safety shutter incrementally

Entering **1** will activate the tube present and shutter sensors (QS=Query Sensors). With the lid

Entering **2** will open the shutter.

Entering **3** will close the shutter.

Entering **4** will move the shutter slightly toward the open position.

Entering **5** will move the shutter slightly toward the closed position.

## ***TROUBLESHOOTING***

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The following is a guide to assist in the troubleshooting and repair of the OPTOCOMP I and II Luminometer. Should you still require assistance after consulting this guide, please contact MGM Instruments Technical Service at 203-248-4008 or 1-800-551-1415 in the continental U.S.

SYMPTOM	POSSIBLE CAUSE
Cassette Drive Error (OPTOCOMP II)	Broken Drivebelt Drive gear loose Drive sensor failure
Cassette Stall Error	Drive tab bent Motor failure (gear Box) Debris blocking tab sensor Improper setup of cassettes Warped cassettes
Display shifted	82C55 U3
High instrument backgrounds	Photomultiplier tube Preamp Reagent residue in counting chamber Light leak due to a poor seal
High voltage missing	High voltage transformer
IL Sensor failure	Index locator sensor (Optocomp II ONLY) contaminated with reagent Bad index locator
Low Injector Volume	Injector lines plugged Injector fittings loose Bellows to valve connection loose Valve clogged Injector requires adjustment
Keypad doesn't respond	Bad keyboard-replace
Membrane keypad cracked	Replace membrane
Memory Loss	Bad battery RAM socket

		OPTO II foot interference*
Instrument doesn't count		PMT failure Pre-amp failure High voltage failure +/-5 volt failure on main board
Printer Failure		Printer unplugged Main board power supply failure Printer jammed with paper Printer head blown (printing partial characters)
Sensor failures	Lid Sensors	Loose connection on LED or phototransistor (OPTOCOMP I) Broken sensor module (OPTOCOMP II) Loose connector LED or phototransistor plugged in backward Defective LED, phototransistor, or module
	Shutter Sensors	Loose connection on LED or phototransistor Sensor connected backward Defective LED, phototransistor, or module Shutter gear loose Shutter motor bad
	Tube Sensor	LED requires adjustment (OPTOCOMP I) OPTOCOMP II sensor flag binding OPTOCOMP II tube sensor binding due to reagent contamination Defective LED, phototransistor, or module

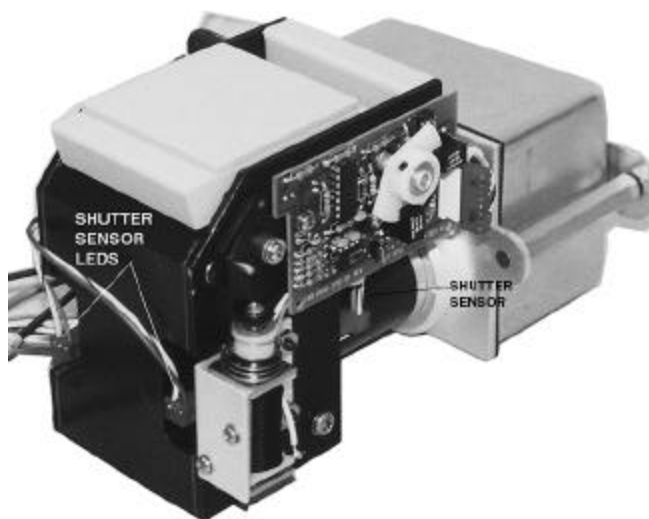


### ***Trouble shooting shutter stall problems.***

Shutter stall errors indicate that the main printed circuit board has detected that the shutter motor is drawing excessive current when attempting to move the shutter to either the open or closed position.

The first thing to check are connections at J-5 on the main printed circuit board. This is the large (34 pin) connector with multi-colored wires which is attached to the main harness, the other end of which is attached to the well chamber (or block) assembly. Also check the connection at J-12 on the main printed circuit board, a 12 pin brown connector near J-5.

If the problem is not caused by loose connections then there is either a problem 1) mechanically with the shutter motor or shutter or shutter drive gear that is causing mechanical binding, 2) with the shutter position sensing system (see below) or 3) with the drive circuitry on the main printed circuit board. Also, pressing the LID RELEASE button may cause a shutter stall error.



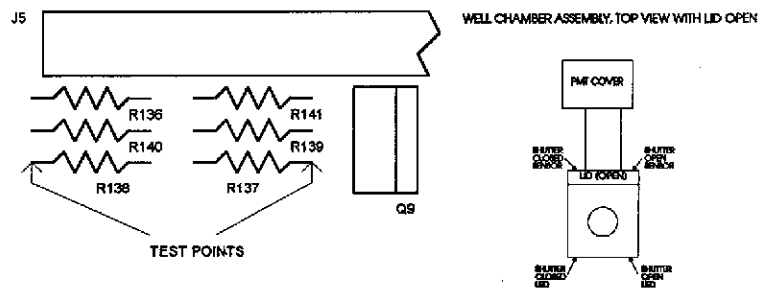
One symptom that can be helpful when attempting to troubleshoot a shutter stall problem is to note when the error occurs. If the error occurs when the instrument is turned on this indicates that the problem occurs when trying to close the shutter. Press the stop key to see if the main menu will appear. If the main menu is displayed then try to run a protocol. Close the lid and attempt to read a tube. If a shutter stall error occurs before the tube is read this indicates that the error occurs when the instrument is attempting to open the shutter. If the error occurs after the tube is read, but before the lid is opened this indicates that the error occurs when the instrument is attempting to close the shutter. While allowing the instrument to attempt to move the shutter listen carefully to the motor. Can you hear it running for a brief (perhaps half second) period? If you can hear it running this indicates that the problem is probably with the sensor system. In other words the motor is able to move the shutter but the main board may be unable to sense when the desired position is reached. In this case the shutter would reach a hard stop and the motor would then draw excessive current resulting in a stall error.

If the motor does not seem to be running at all then the problem is either with the motor, mechanical jamming, or the drive circuitry. The shutter motor can be checked after removing it from the well chamber assembly. Remove the two screws that secure the motor's mounting plate to the well chamber assembly. The motor can then be removed from the block and it and its drive gear examined. If J-12 is disconnected from the main printed circuit board then the motor's operation can be checked while removed from the block by connecting it to an external 12 volt DC supply. The motor should turn freely. If it will not turn then the motor should be replaced.

If the motor is able to move the shutter freely then an error in the position sensing system should be suspected. If errors occur only when attempting to close the shutter then check the Shutter Closed LED and sensor. If errors occur only when attempting to open the shutter then check the Shutter Open LED and sensor. See attached drawing showing location of the LEDs and sensors.

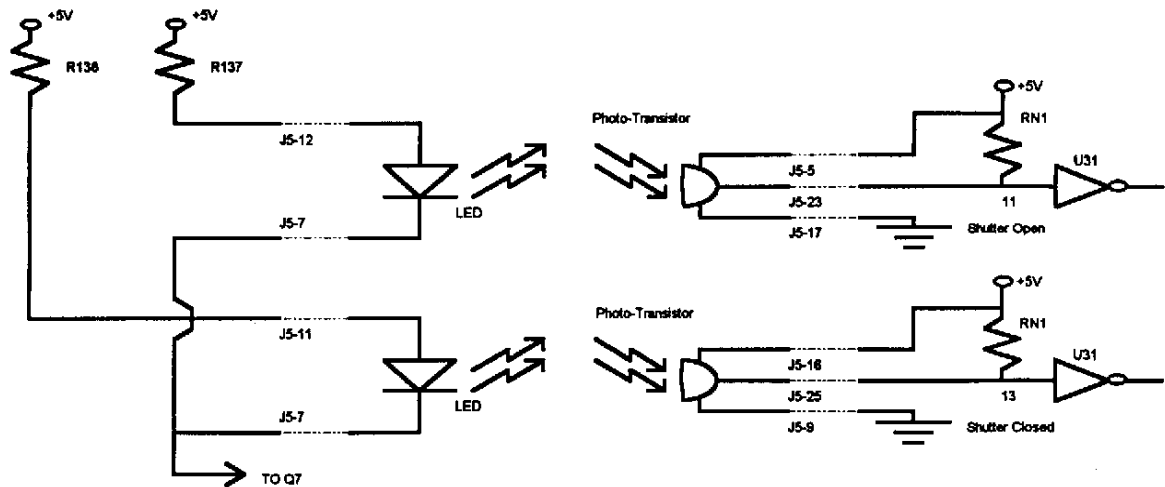
The procedure to check operation of the shutter sensors is as follows:

Close the LID, disconnect the High Voltage, and ground the TAB of transistor Q7. This will turn on the shutter LEDs (and the tube present LED). Disconnect J12 and apply the external power supply of +12VDC to the shutter motor to move it manually. Applying the +12VDC to the blue wire (pin 8 of J12) and the ground to the orange wire (pin 7 of J12) will cause the shutter to move to the closed position. When the shutter has moved completely to the closed position, disconnect the power supply from the motor. Next measure the voltages at the following points: J5 pin 11 (can be measured at R137, see diagram below) and J5 pin 12 (can be measured at R138). These points are the anodes of the Shutter Closed and Shutter Open LEDs used to sense shutter position. Both of these points should be 1.1 to 1.4 VDC (measured with respect to ground). If either of these points measures around 5 VDC, this would mean the corresponding LED is open or the connection to the LED has opened (check for continuity from the resistor to each LED, if the connection is good, the LED may have failed or the connection on the ground side of the LED may have come loose).



If both of the voltages measured above check out properly, check the photo-transistor as follows: with the shutter still in the CLOSED position and the TAB of Q7 still connected to ground, locate U31 and measure the voltages at pins 11 and 13. Pin 11 should be logic low (close to ground) and pin 13 should be logic high (above 3.5 VDC). The LID **must** be closed and the High Voltage disconnected when the following is done, otherwise the PMT may be exposed to room light. Connect the external +12VDC power supply to the shutter motor again, this time reversing the connection (+12VDC to the orange wire, pin 7 on J12, and ground the blue wire, pin 8 on J12). This will move the shutter to the open position.

Once again measure the voltages at pins 11 and 13 of U31. This time pin 11 should be high and pin 13 should be low. If you do not see these conditions then either one of the photo-transistors has failed or a connection has come loose. Pin 11 of U31 should be directly connected to the output of the Shutter Open photo-transistor and pin 13 of U31 should be directly connected to the output of the Shutter Closed photo-transistor. The connections to each photo-transistor are as follows:



What to look for when a shutter stall error occurs:

1. Potentiometer R96 not fully counter-clockwise
2. Connector J5 or J12 loose
3. Shutter not moving properly because of jammed gear or loose shutter rack screw
4. Injector precipitant dried in shutter area
5. Problem with seating of either Shutter Open LED, Shutter Open Sensor, Shutter Closed LED, or Shutter Closed Sensor in connectors of block assembly
6. Short on motor
7. Short on R79
8. Open on R79
9. Blown motor driver (U8 or U9)
10. If problem occurs when turning instrument on or after tube is read, look at Shutter Closed circuitry first
11. If problem occurs when starting a protocol, look at Shutter Open circuitry first

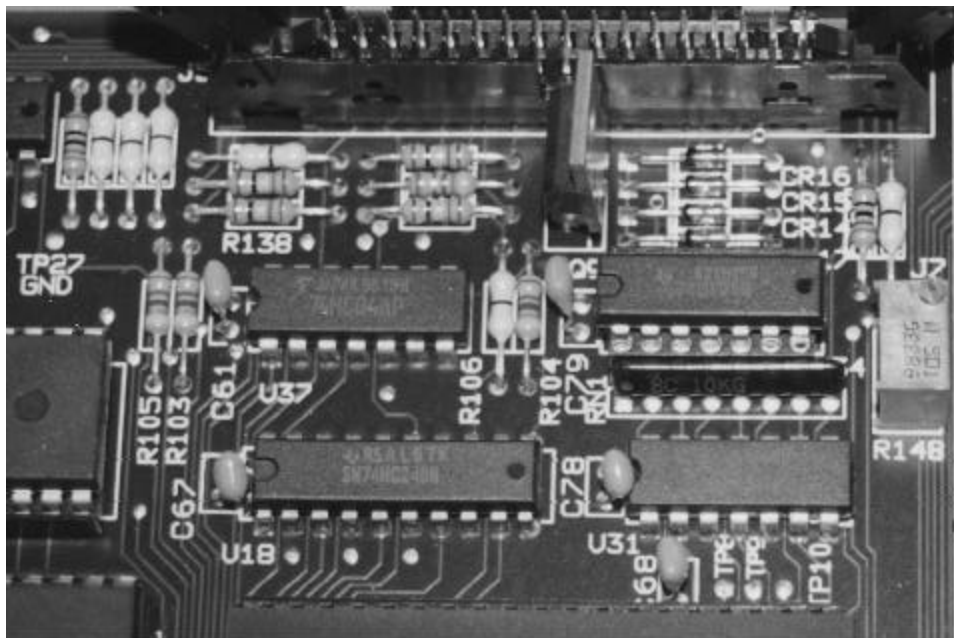
Finally, a shutter stall error may occur after hitting the LID RELEASE button while waiting at the main menu with the lid open. This can happen because the CPU is constantly polling to check if the lid is open. If the lid is open, the CPU checks to make sure the shutter is closed. If the LID RELEASE key is struck while the CPU is checking to see if the shutter is closed, a shutter error may occur. The LID RELEASE key usually has to be struck repeatedly for this to happen, as the chances of interrupting the CPU with a LID RELEASE request at the moment it is checking the shutter position are small. This issue will be fixed in future software releases.

## ADJUSTING OPTOCOMP I TUBE SENSOR

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The tube sensor protects the OPTOCOMP from injecting reagents into an empty sample chamber.

1. With power applied, Press the Lid Release button.
2. Turn the power off and remove the power cord from the wall outlet.
3. Remove the Top Cover and Front Panel (OPTOCOMP I) or remove the two screws at the top of the Front Panel (OPTOCOMP IB). *Do not disconnect the cables from the Front Panel.*
4. Using a test lead (ball clip, alligator clip etc.) connect the tab of Q-7 on the Main PCB to ground. This will cause the Tube Present LED to be "on" continuously.
5. Restore power to the OPTOCOMP. **CAUTION: Dangerous voltages exist inside the instrument. Use extreme caution!**
6. Using a voltmeter or oscilloscope, measure the voltage at JP-11 to determine the output state of the Tube Present sensor. A logic level low (~ 0 volts) indicates that the sensor is turned on. This is the state with no tube in the well.
7. Adjust R-148 on the Main PCB counterclockwise until the logic state at JP-11 changes to a logic high level (4-5 VDC). This is the proper state with a tube in the well.



8. Adjust R-148 clockwise until the sensor just turns on.
9. Place a clean, empty, test tube in the well (preferably polystyrene). Adjust R-148 clockwise, counting the number of turns necessary to make the sensor turn on once again or the potentiometer has reached the end of its adjustment (this is indicated by the potentiometer clicking). NOTE: If the sensor cannot be made to turn back on, or if the number of turns to the end of adjustment is 5 turns or less, the LED and /or photo sensor MUST BE REPLACED. After replacing an LED or photosensor, it is necessary to start the adjustment process from the beginning.

10. Once the parameters of step 9 have been met, adjust R-148 counter-clockwise for half the counted number of turns. This will set the adjustment approximately halfway between the detection limits of the photosensor.
11. Turn the OPTOCOMP off and remove the test lead from Q-7.
12. Turn the OPTOCOMP on again and program a Raw Data protocol for five sample replicates, with a count time of 1 second.
13. Check for proper operation of the Tube Present Sensor by placing a clean tube in the well, and completely removing it after every acquisition.
14. Close the lid once or twice with no tube in the well and check that the instrument does not perform an acquisition with an empty sample chamber
15. When the tube sensor is determined to be satisfactory, replace covers and panels as necessary.

## ***COVER REMOVAL***

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### ***REMOVING COVERS FROM THE OPTOCOMP I***

THE FOLLOWING STEPS SHOULD BE PERFORMED ONLY WITH THE INSTRUMENT TURNED OFF AND THE POWER CORD DISCONNECTED.

To remove the covers from the OPTOCOMP I;

1. Remove the four Philips head screws, two from either side of the top cover (see below)



Lift the Top Cover straight up and place on the left side of the instrument, as shown below.



Next, remove the four flat head screws, two from either side of the front panel, as shown below.



Disconnect and remove the Front Panel. The inside of the OPTOCOMP shown now be completely exposed.

### ***REMOVING COVERS FROM THE OPTOCOMP IB***

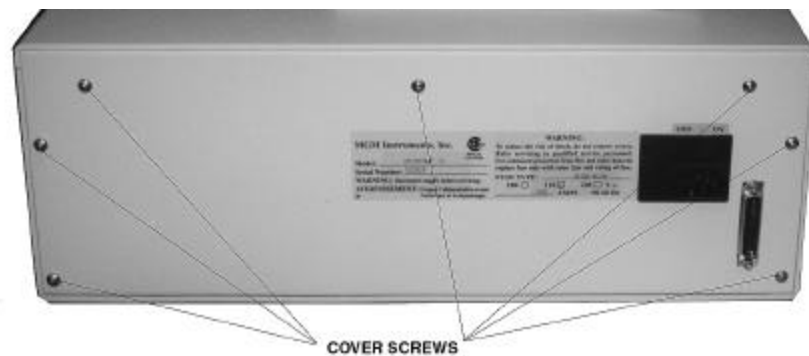
Remove the two screws from the top rear of the Front panel as shown below.



Lift the cover and rotate it toward the front of the instrument as shown.



This will expose the Front Panel components, Main PCB as well as the Shutter Block. If access to the Preamp, PMT, or Injectors is necessary, remove the rear cover by removing the six screws as shown. With the screws removed, lift the panel straight up to remove.





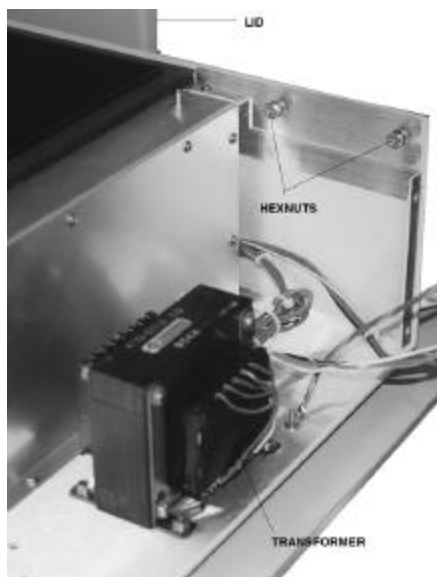
## ***REMOVING COVERS FROM THE OPTOCOMP IIB***

To remove the covers from the OPTOCOMP II B, first with power applied, press the Lid Release button on the front panel. Open the lid and turn the instrument off and unplug the power cord from the wall socket.

Remove the two screws from the top of the Front Panel.



Lift the panel up and rotate it forward as with the OPTOCOMP IB. This will allow access to the Front Panel components as well as the Front Cassette drive mechanism and associated sensors. To gain access to Injectors, Rear cassette drive, or Power Transformer, remove the six Philips head screws from the Rear Panel. Lay the panel down at the rear of the instrument. To remove the lid, remove the three Philips head screws at the rear of the Cassette Housing. Loosen the four 11/34 hexnuts located under the lid in the rear of the instrument. NOTE: It is not necessary to completely remove these nuts, they need only be loosened since the lid is slotted. The illustration below shows the location of the two nuts on one side of the instrument.



## ***COMPONENT REPLACEMENT***

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This section is meant for use as a guide to the replacement of certain components or modules in the OPTOCOMP I and II luminometer. Should further assistance be necessary, please contact MGM Instruments Technical Assistance.

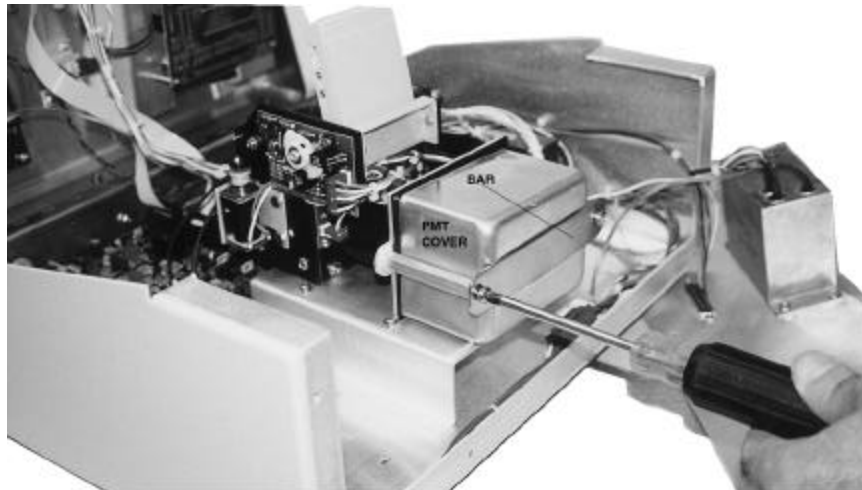
### ***PREAMP REPLACEMENT-OPTOCOMP I***

Part Number 998062

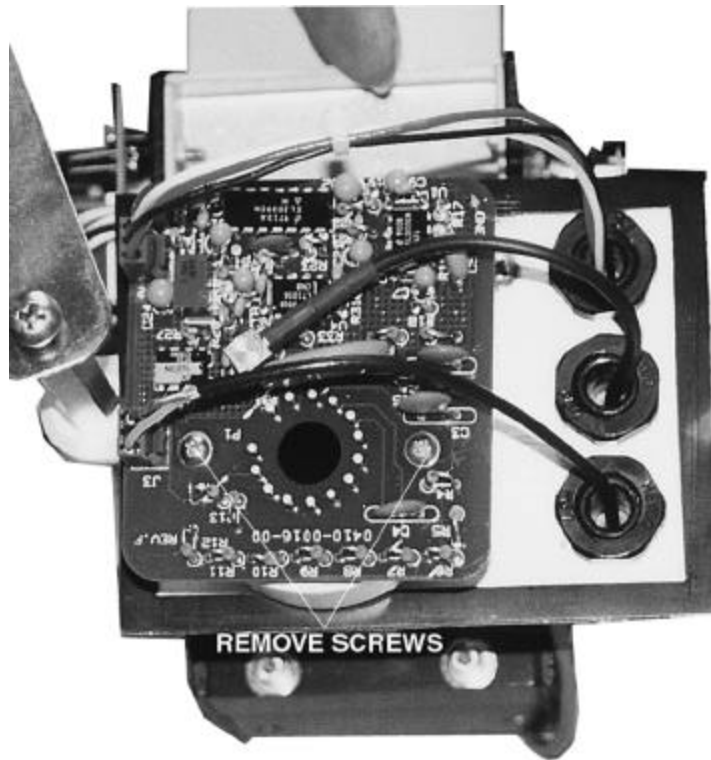
Tools required: Philips screwdriver #1 and #2 point, 5/16 wrench or nut driver, voltmeter, small flat blade screwdriver.

**To replace the PREAMP on the OPTOCOMP I follow these steps;**

1. Turn the OPTOCOMP I off and remove the power cord from the receptacle
2. (OPTOCOMP I ONLY) Remove the Top Cover by removing the four screws (two on either side) and lifting straight up. NOTE: The printer harness will have enough slack to allow the top cover to be placed on its lift side during this procedure. Should you prefer, you can disconnect all cables which are connected to the top cover and place it aside.
3. Remove the 5 screws holding the rear panel and set it aside
4. (OPTOCOMP IB ONLY) Remove the two screws securing the front panel located on the back lip of the front panel toward the rear of the instrument. Pull the front panel toward you. It is hinged and will stay in the upright position.
5. Remove the 6 screws holding the rear panel. Lift the panel straight up and remove it from the instrument.
6. Remove the two screws from the PREAMP COVER. Remove the BAR AND COVER form the PREAMP.



7. Disconnect the three wire harness from the PREAMP. (Two coaxial cables and one discreet wire harness). Using a 5/16 wrench, loosen and remove the nut holding the groundlug to the PREAMP mounting plate.
8. Remove the two screws holding the PREAMP. CAUTION: There are two nylon spacers on the back of the PREAMP which will fall off when the screws are removed.



9. Carefully remove the PREAMP. NOTE: The PREAMP is pressed onto the PHOTOMULTIPLIER TUBE or PMT. It may be necessary to gently wiggle or rock the PREAMP until it is free of the PMT.
10. Check the Revision Level of the replacement PREAMP to make sure that it is at least the same or higher than the one being replaced. The Revision Level is printed in the upper right hand corner of the component side of the PREAMP.
11. Install the new PREAMP by carefully pushing it onto the pins of the PMT. NOTE The PMT is “keyed” to prohibit incorrect connection.
12. Replace the groundlug onto the stud and tighten the nut with the 5/16 wrench.
13. Connect the three cables to the PREAMP. NOTE: The coaxial cable with the three position connector should be plugged into J3 on the PREAMP.
14. It is good practice at this point to check that the threshold voltage is properly set on the PREAMP. Before replacing all of the covers on the instrument, connect the voltmeter between ground and U4 pin 2 on the PREAMP. This is easily accomplished by connecting to R29 which is located next to the potentiometer R28. R29 is the middle resistor of the three located on the right of R28. Carefully apply power to the instrument

- and check the voltage. If necessary, adjust R28 until the voltmeter reads 25mV. Turn the instrument off at this point.
15. Check that all connections are properly made. Install the two screws to hold the PREAMP using the two nylon spacers on the back of the PREAMP.
  16. Install the PREAMP cover, bar and two screws.
  17. Replace rear panel.
  18. Replace top cover.
  19. Refer to Operators Manual Section VII-5 and perform a Q/A test to assure that the instrument is operating properly.

### ***PREAMP REPLACEMENT-OPTOCOMP II***

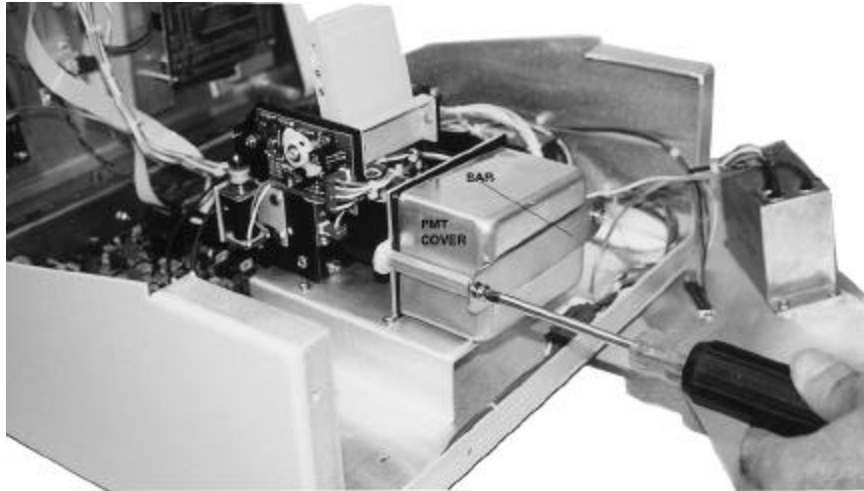
1. Press the LID RELEASE button on the front panel and open the lid. Turn the OPTOCOMP II off and remove the plug from the wall receptacle.
2. Remove the 4 large Philips head screws from the top of the PMT cover. Remove the 4 smaller Philips head screws from either side of the PMT cover. Remove the PMT cover.
3. Stand the PMT/SHUTTER BLOCK on the shutter cover and remove the 3 wires
4. Connected to the PREAMP. Remove the grounding lug from the ring on the PMT.
5. Remove the two screws securing the PREAMP being careful not to loose the two spacers from beneath the PREAMP.
6. Gently lift the PREAMP off the PMT. It may be necessary to wiggle it slightly to free it from the pins of the PMT.
7. Install the new PREAMP and refer to steps 10 through 15 above for installation procedures.
8. Plug the instrument in and turn it on. Refer to the Operator's Manual for instructions on running Q/A to assure proper operation.

### ***PMT REPLACEMENT-OPTOCOMP I***

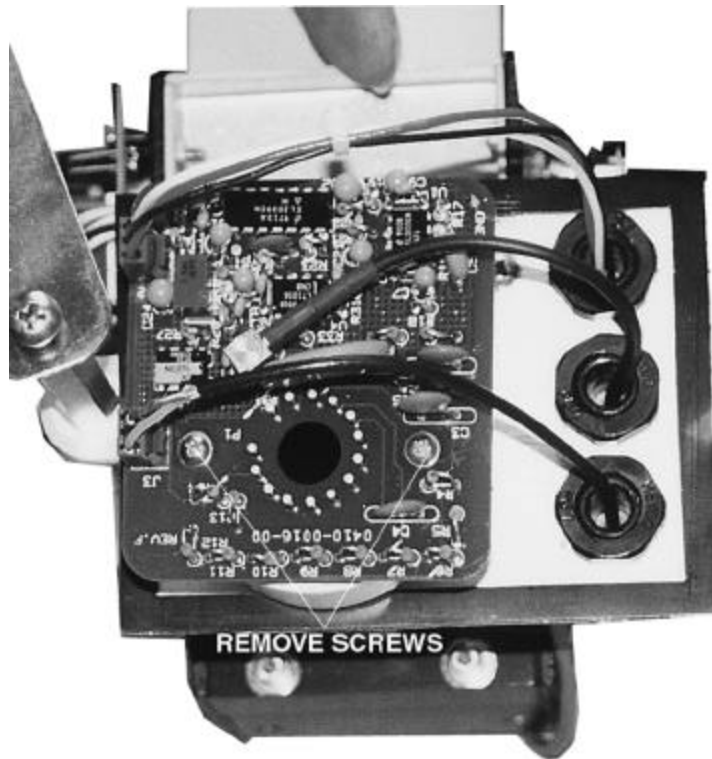
Part Number 0300-0048-00

Tools required: Philips screwdriver # 1 and # 2 point, Tritium calibration source.

1. Turn the OPTOCOMP I off and remove the plug from the wall receptacle.
2. (OPTOCOMP I ONLY) Remove the Top Cover by removing the four screws (two on either side) and lifting straight up. (See section "Removing Covers")
3. Remove the 5 screws holding the rear panel and set it aside.
4. (OPTOCOMP IB ONLY) Remove the two screws securing the front panel located on the back lip of the front panel toward the rear of the instrument. Pull the front panel toward you. It is hinged and will stay in the upright position.
5. Remove the screws holding the rear panel. Lift the panel straight up and remove it from the instrument.



6. Remove the two screws from the PREAMP COVER. Remove the BAR and COVER from the PREAMP.
7. Remove the two screws holding the PREAMP. CAUTION: There are two nylon spacers on the back of the PREAMP which will fall off when the screws are removed.



8. Carefully remove the PREAMP. NOTE: The PREAMP is pressed onto the PHOTOMULTIPLIER TUBE or PMT. It may be necessary to gently wiggle or rock the PREAMP until it is free of the PMT. Place the PREAMP aside. It is not necessary to disconnect the wires or the ground lug from the PREAMP to change the PMT.

9. Remove the PMT from the SHUTTER BLOCK assembly. If necessary use a small pair of NEEDLE NOSE pliers to grip one of the pins on the PMT and, using extreme caution, lift straight up.
10. Check the replacement PMT to make sure that the felt packing is in place (about an inch from the PMT “window”). NOTE: Do not expose the PMT to any excess ambient light as this will shock the PMT and cause the PMT to operate erratically for the first hour or so after power is applied. Leave the rubber cover on the PMT until you are ready to install it into the SHUTTER BLOCK.
11. Install PMT.
12. Replace the PREAMP by lining up the pins on the PMT with the sockets on the PREAMP. If necessary, gently rotate the PREAMP to align it with the mounting holes on the ring.
13. Install the two screws, which secure the PREAMP to the mounting ring using care to assure that the two nylon spacers are installed on the back side of the PREAMP.
14. Install the PREAMP cover, bar and two screws.
15. Replace rear panel.
16. Replace top cover.
17. Restore power to the OPTOCOMP I.
18. From the MAIN NEMU, press the UTILITIES key on the keypad.
19. Press 11, ENTER, RESUME.
20. Set the PMT FACTOR to 1 and press ENTER.

Whenever the PMT is replaced, it is necessary to reset the PMT factor. The PMT factor is determined using the Q/A procedure (Operator's Manual Section VII-Maintenance).

With the CAL FACTOR set to 1 and the PMT FACTOR set to 1, the CALIBRATION NUMBER which is reported at the bottom of the Q/A Report becomes the PMT FACTOR.

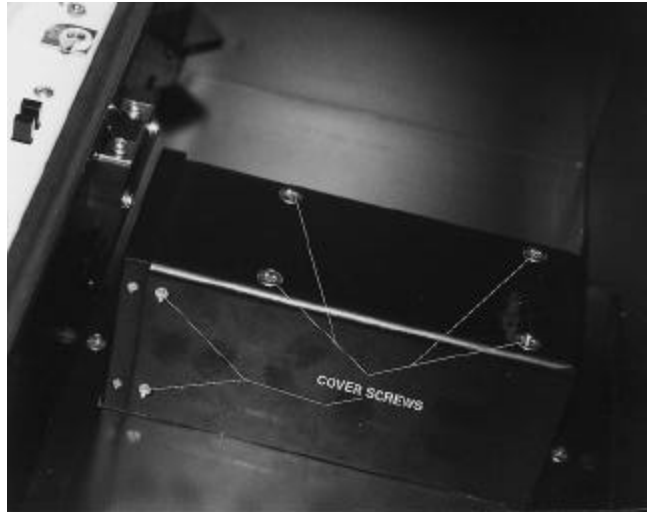
After running Q/A, from the MAIN MENU, press **UTILITIES, 11, ENTER, RESUME.**

The OPTOCOMP will prompt you to enter a new PMT FACTOR. Enter the number reported as the CALIBRATION NUMBER on the Q/A report, and press **ENTER.**

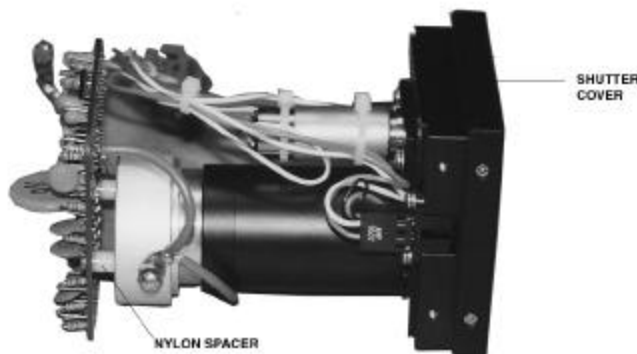
Rerun the Q/A procedure now to insure that the CALIBRATION NUMBER is within 2% of 1.000.

## ***PMT REPLACEMENT-OPTOCOMP II***

1. Press the LID RELEASE button on the front panel and open the lid. Turn the OPTOCOMP II off and remove the plug from the wall receptacle.
2. Remove the 4 large Philips head screws from the top of the PMT cover. Remove the 4 smaller Philips head screws from either side of the PMT cover. Remove the PMT cover.



3. Stand the PMT/SHUTTER BLOCK on the shutter cover. Remove the two screws securing the PREAMP careful not to loose the two spacers from beneath the PREAMP.



4. Gently lift the PREAMP off the PMT. It may be necessary to wiggle it slightly to free it from the pins of the PMT.
5. Check the replacement PMT to make sure that the felt packing is in place (about an inch from the PMT “window”). NOTE: Do not expose the PMT to any excess ambient light as this will shock the PMT and cause the PMT to operate erratically for the first hour or so after power is applied. Leave the rubber cover on the PMT until you are ready to install it into the SHUTTER BLOCK.
6. Install the new PMT.

7. Replace the PREAMP by lining up the pins on the PMT with the sockets on the PREAMP. If necessary, gently rotate the PREAMP to align it with the mounting holes on the ring.
8. Install the two screws which secure the PREAMP to the mounting ring using care to assure that the two nylon spacers are installed on the back side of the PREAMP.
9. Reassemble the PMT cover assembly and install it into the cassette housing.
10. Plug the instrument in and turn it on.
11. Reset the PMT FACTOR as described above.

## ***MAIN PC BOARD REPLACEMENT – OPTOCOMP I***

Tools required: Philips screwdriver # 1 and # 2 point, small flat blade screwdriver or tuning screwdriver.

1. Remove the four screws holding the TOP COVER, (two on either side), and lift the TOP COVER off of the base. There should be enough slack in the connecting cables to allow for the TOP COVER to be placed on its right side.
2. Remove the four screws holding the FRONT PANEL, (two on either side), and remove the FRONT PANEL. NOTE: There are three cables connected to the FRONT PANEL that must be disconnected before the panel can be removed.
3. Disconnect all wires and cables from the MAIN PCB.
4. Remove seven Philips head screws securing the MAIN PCB.
5. Remove the MAIN PCB.
6. Check the replacement PCB for matching revision level. NOTE: It may be necessary to retain the EPROMS(S) from the original PCB for use in the replacement.
7. Install new PCB into the base and replace the seven screws.
8. Replace the wires and cables to their respective plugs as follows;

J1	AC power from main transformer
J2	High voltage cable from PREAMP
J3	5vdc for PREAMP
J4	Signal cable from PREAMP
J5	40 pin connector from sensors
J6	Printer power
J7	Printer data cable
J8	Ribbon cable from display
J9	Ribbon cable from keyboard
J10	RS-232 harness
J11	Injector harness
J12	Motor harness
9. Check the High Voltage setting of the replacement PCB as follows: Connect a voltmeter between the J2 pins 1 and 3 on the PCB. Connect a test lead, Ball Clip to Alligator, between U-16 pin 6 and ground. This is necessary due to the fact that the high voltage is



- not turned on unless the lid is closed and the safety shutter is open. Grounding U16 pin 6 defeats the feature.
10. Set the voltmeter to a range that will accept up to 1500 VDC.
  11. Turn the OPTOCOMP on and observe the voltmeter. The high voltage setting should be 1100 VDC. If necessary, adjust R13 on the MAIN PCB until the voltage at J2=1100 VDC. NOTE: If the voltage is at or around 460 VDC and will not change when R13 is adjusted, check the connection of the ground lead to U16 pin 6.
  12. Turn the OPTOCOMP off, and remove the meter leads and the test lead connected to U16.
  13. Replace the FRONT PANEL and TOP COVER.

## ***MAIN PC BOARD REPLACEMENT – OPTOCOMP II***

1. With power applied to the OPTOCOMP, press the LID RELEASE button on the front panel, and open the lid.
2. Turn off power to the OPTCOMP and remove the plug from the wall socket.
3. Remove the four screws from the outer shroud (two screws on either side). Remove the shroud.
4. Remove the three Philips head screws from the top of the front panel.
5. Remove the four flat head screws from the sides of the front panel, and remove the front panel.
6. Disconnect all wires and cables from the MAIN PCB.
7. Remove seven Philips head screws securing the MAIN PCB.
8. Remove the MAIN PCB.
9. Check the replacement PCB for matching revision level. NOTE: It may be necessary to retain the EPROM(S) from the original PCB for use in the replacement.
10. Install new PCB into the base and replace the seven screws.
11. Replace the wires and cables to their respective plugs as follows;

J1	AC power from main transformer
J2	High Voltage cable from PREAMP
J3	5vdc for PREAMP
J4	Signal cable from PREAMP
J5	40 pin connector from sensors
J6	Printer power
J7	Printer data cable
J8	Ribbon cable from display
J9	Ribbon cable from keyboard
J10	RS-232 harness
J11	Injector harness
J12	Motor harness

12. Check the High Voltage setting of the replacement PCB as follows: Connect a voltmeter between the J2 pins 1 and 3 on the PCB. Connect a test lead, Ball Clip to Alligator Clip etc, between U-16 pin 6 and ground. This is necessary due to the fact that the high

- voltage is not turned on unless the lid is closed and the safety shutter is open. Grounding U16 pin 6 defeats this feature.
13. Set the voltmeter to a range that will accept up to 1500 VDC.
  14. Turn the OPTOCOMP on and observe the voltmeter. The high voltage setting should be 1100 VDC. If necessary, adjust R13 on the MAIN PCB until the voltage at J2=1100 VDC. NOTE: If the voltage is at or around 460 VDC and will not change when R13 is adjusted, check the connection of the ground lead to U16 pin 6.
  15. Turn the OPTOCOMP off, and remove the meter leads and the test lead connected to U16.
  16. Replace front panel using care to ensure that the pin for the lid latch mechanism fits into the slot on the lid latch plate. Set the panel in place, apply power to the OPTOCOMP, and press the LID RELEASE button once or twice to make sure that the solenoid fires and the lid latch plate rotates.
  17. Install all front panel screws.
  18. Install front shroud and screws.

### ***MAIN PC BOARD REPLACEMENT – OPTOCOMP I B AND II B***

1. Press the LID RELEASE button and open the lid (OPTOCOMP IIB only).
2. Turn the power off and remove the plug from the wall socket.
3. Remove the two Philips head screws from the top of the front panel, and lift the front panel to a vertical position.
4. Disconnect all wires and cables from the MAIN PCB.
5. Remove seven Philips head screws securing the MAIN PCB.
6. Remove the MAIN PCB.
7. Check the replacement PCB for matching revision level. NOTE: It may be necessary to retain the EPROM(S) from the original PCB for use in the replacement.
8. Install new PCB into the base and replace the seven screws.
9. Replace the wires and cables to their respective plugs as follows;

J1	AC power from main transformer
J2	High voltage cable from PREAMP
J3	5vdc for PREAMP
J4	Signal cable from PREAMP
J5	40 pin connector from sensors
J6	Printer power
J7	Printer data cable
J8	Ribbon cable from display
J9	Ribbon cable from keyboard
J10	RS-232 harness
J11	Injector harness
J12	Motor harness
10. Check the High Voltage setting of the replacement PCB as follows: Connect a voltmeter between the J2 pins 1 and 3 on the PCB. Connect a test lead, Ball Clip, Alligator Clip

etc, between U-16 pin 6 and ground. This is necessary due to the fact that the high voltage is not turned on unless the lid is closed and the safety shutter is open. Grounding U16 pin 6 defeats this feature.

11. Set the voltmeter to a range that will accept up to 1500 VDC.
12. Turn the OPTOCOMP on and observe the voltmeter. The high voltage setting should be 1100 VDC. If necessary, adjust R13 on the MAIN PCB until the voltage at J2=1100 VDC. NOTE: If the voltage is at or around 460 VDC and will not change when R13 is adjusted, check the connection of the ground lead to U16 pin 6.
13. Turn the OPTOCOMP off, and remove the meter leads and the test lead connected to U16.
14. Replace the front panel.

## ***REPLACING THE DISPLAY – OPTOCOMP I***

Tools required: Philips screwdriver

1. Turn the OPTOCOMP off and remove the power cord from the wall socket.
2. Remove the top cover. NOTE: There is enough slack in the printer harness to allow the top cover to be placed on its side on the side of the instrument to the operator's left.
3. Remove the four screws holding the front panel.
4. Disconnect all wires and cables from the Front Panel to the Main PCB.
5. Remove the front panel.
6. Place the front panel upside down on a table or bench top.
7. Remove the two screws holding the display at the end near the red and black wires.
8. Remove the two flat head screws and plastic shoulder washers from the opposite end of the display.
9. Remove the display.
10. Install the new display.
11. Install the two pan head screws through the mounting holes in the display near the red and black wires.
12. Install the two flat head screws and shoulder washers to the other standoffs in the front panel taking care to mount the washers with the shoulder facing the front panel.
13. Connect the cables from the keyboard and display to the proper places on the MAIN PCB;  

J9-keyboard  
J8-display ribbon cable  
J13-display backlight
14. Replace front panel
15. Replace top cover.

## ***REPLACING THE DISPLAY – OPTOCOMP II***

1. With power applied, press the lid release button on the front panel.
2. Remove the four screws from the front shroud and remove the shroud.
3. Remove the three screws from the top of the front panel, and the four screws from the side of the front panel.
4. Gently lift the front panel toward the front of the instrument, and disconnect the lid sensor.
5. Disconnect the lid release button.
6. Disconnect the two cables from the display to the Main PCB.
7. Disconnect ribbon cable from the keyboard to the MAIN PCB.
8. Disconnect the printer harness from the main PCB.
9. Remove the front panel and place upside down on a table or bench top.
10. Remove the two screws holding the display at the end near the red and black wires.
11. Remove the two flat head screws and plastic shoulder washers from the opposite end of the display.
12. Remove the display.
13. Install the new display.

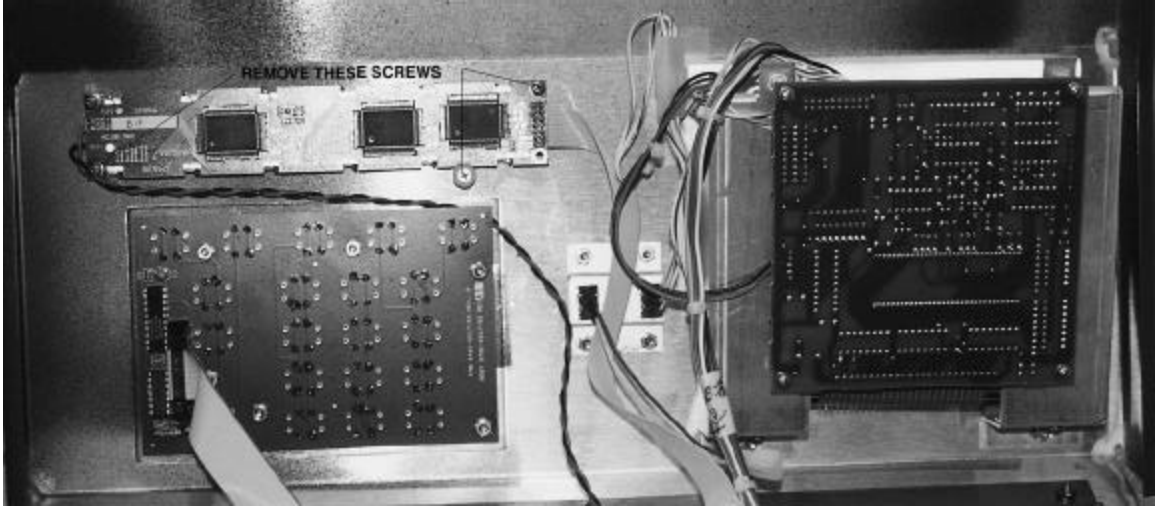
14. Install the two pan head screws through the mounting holes in the display near the red and black wires.
15. Install the two flat head screws and shoulder washers to the other standoffs in the front panel taking care to mount the washers with the shoulder facing the front panel.
16. Connect the cables from the keyboard and display to the proper places on the MAIN PCB;

J9-keyboard  
J8-display ribbon cable  
J13 display backlight

17. Connect the lid sensor.
18. Replace front panel.
19. Replace front shroud.

## ***REPLACING THE DISPLAY – OPTOCOMP IB AND IIB***

1. With power applied press the Lid Release button and open the Lid. (OPTOCOMP IIB only).
2. Turn off power to the instrument and remove the plug from the wall socket.
3. Remove the two screws from the top of the front panel.
4. Lift the front panel and place it in a vertical position.



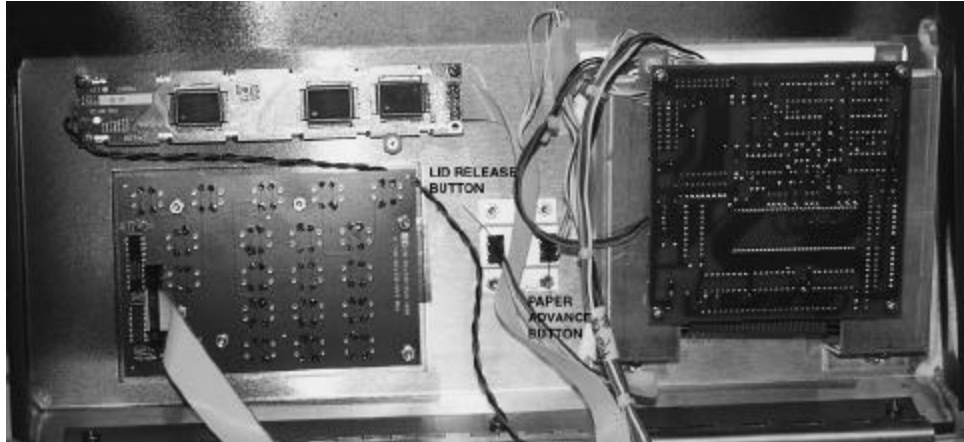
*Figure 2: Optocomp IB front panel, rear view*

5. Disconnect the display ribbon cable, and the two wire backlighting harness from the Main PCB.
6. Remove the four screws from the display.
7. Remove the display.
8. Install the new display.
9. Replace the four mounting screws.
10. Connect the cables from the keyboard and display to the proper places on the MAIN PCB;  
J9-keyboard  
J8-display ribbon cable  
J13-display backlight
11. Close the front panel and replace the two screws at the top of the front panel.

## ***REPLACING PUSH-BUTTON ASSEMBLY- OPTOCOMP I***

Tools required; Philips head screwdriver, 1/4" wrench or nutdriver

1. Turn the OPTOCOMP off and remove the power cord from the wall socket.
2. Remove top cover.
3. Remove screws from Front Panel
4. Disconnect all wires and cables from the Front Panel
5. Remove Front Panel.



*Figure 3: Optocomp IB Pushbutton assembly*

6. Remove the four hex nuts holding the push-button mounting plate.
7. Remove the push button plate.
8. Install replacement push-button assembly. NOTE: It may be necessary to retain the red and white buttons (switch covers) from the original assembly. These are simply pressed on, and can easily be removed by gently pulling on them.
9. Replace hex nuts and washers.
10. Place front panel gently into the base
11. Connect the push buttons to the proper harnesses (lid release to motor harness, paper advance to the printer harness).
12. Install screws into front panel.
13. Replace top cover.

## ***REPLACING PUSH-BUTTON ASSEMBLY - OPTOCOMP II***

1. With power applied, press the lid release button on the front panel and open the lid.
2. Turn the OPTOCOMP II off and remove the power cord from the wall socket.
3. (See section Removing covers) Remove the FRONT SHROUD by loosening the four Philips head screws (two on either side).
4. Remove the Front Panel by removing the three Philips head screws from the top of the Front Panel and the four flat head screws from either side of the Front Panel and lifting the panel straight up.
5. Disconnect all cables and wires from the Front Panel.

6. Place the front panel upside down on a table or bench top.
7. Remove the four hex nuts holding the push-button mounting plate.
8. Remove the push button plate.
9. Install replacement push-button assembly. NOTE: It may be necessary to retain the red and white button (switch covers) from the original assembly. These are simply pressed on, and can easily be removed by gently pulling on them.
10. Replace hex nuts and washers.
11. Reconnect all cables and wires to the Front Panel
12. Replace Front Panel screws.
13. Replace Front Shroud.

### ***REPLACING PUSH-BUTTON ASSEMBLY - OPTOCOMP IB AND IIB***

1. With power applied, press the lid release button and open the lid.
2. Turn the OPTOCOMP off and remove the power cord from the wall outlet.
3. Remove the two screws from the top of the front panel and lift the Front Panel to a vertical or open position.
4. Disconnect the Lid release button from the main harness and the Paper Advance button from the printer harness.
5. Remove the four hex nuts holding the push-button mounting plate.
6. Remove the push button plate.
7. Install replacement push-button assembly. NOTE: It may be necessary to retain the red and white buttons (switch covers) from the original assembly. These are simply pressed on, and can easily be removed by gently pulling on them.
8. Replace hex nuts and washers.
9. Connect the Paper Advance Button to the Printer Harness.
10. Connect the Lid Release Button to the Main Harness.
11. Close the Front Panel and replace the two screws.

### ***REPLACING KEYBOARD PCB – OPTOCOMP I***

Tools required; Philips head screwdriver, # 1 and # 2 point

1. Turn the OPTOCOMP off and remove the power cord from the wall socket.
2. Remove the four screws from the top cover.
3. Remove the top cover and place on its side to the (operator's) left of the instrument.
4. Remove the four flat head screws from the sides of the front panel.
5. Disconnect the cables from the keyboard and display to the MAIN PCB.
6. Remove the front panel, and place it upside down on a table or bench top.
7. Remove the six Philips head screws holding the keyboard.
8. Remove the keyboard.
9. Install replacement keyboard. NOTE: It may be necessary to retain the ribbon cable from the original keyboard.
10. Replace six Philips head screws.



11. Connect the keyboard and display to the Main PCB.

J9-Keyboard

J8-Display Ribbon Cable

J13-Display Backlight

12. Replace the front panel and screws.
13. Replace the top cover.

### ***REPLACING KEYBOARD PCB – OPTOCOMP I***

1. With power applied, press the lid release button on the front panel and open the lid.
2. Turn the OPTOCOMP off and remove the power cord from the wall socket.
3. Remove the four screws from the outer shroud and remove the shroud.
4. Remove the three screws from the top of the front panel.
5. Remove the four flat head screws from either side of the front panel.
6. Lift the front panel slightly and disconnect the lid sensor.
7. Lift the front panel further and disconnect the harnesses running from the keyboard, display and printer to the MAIN PCB.
8. Remove the front panel and place upside down on a table or bench top.
9. Remove the six Philips head screws holding the keyboard.
10. Remove the keyboard.
11. Install replacement keyboard. NOTE: It may be necessary to retain the ribbon cable from the original keyboard.
12. Replace six Philips head screws.
13. Return the front panel to the base.
14. Connect the keyboard and display to the Main PCB.

J9-Keyboard

J8-Display Ribbon Cable

J13-Display Backlight

15. Connect the lid sensor.
16. Replace flat head screws to the sides of the panel.
17. Replace the three screws to the top of the front panel.
18. Replace the front shroud.

### ***REPLACING KEYBOARD PCB – OPTOCOMP IB AND IIB***

1. With power applied, press the lid release button on the front panel (OPTOCOMP II only).
2. Remove the two screws from the top of the front panel.
3. Lift the panel to a vertical position.
4. Disconnect the ribbon cable from the keyboard to the MAIN PCB.
5. Remove the six hex nuts from the backside of the keyboard. NOTE: It is necessary to remove the washers and plastic spacers at this time.

6. Remove the keyboard. NOTE: Use care not to lose the spacers from the front side of the keyboard.
7. Install new keyboard making sure that there are spacers between the front panel and the keyboard.
8. Install spacers, washers, and hex nuts.
9. Connect the keyboard to the main PCB using the ribbon cable.
10. Close the front panel and replace the two screws.

## ***REPLACING PRINTER ASSEMBLY - OPTOCOMP I***

Tools required: #1 point screwdriver, ¼" nut driver or socket

1. Turn the power to the instrument off and remove the power cord from the wall receptacle.
2. Remove the Top Cover.
3. Remove the screws from the Front Panel.
4. Lift the Front Panel and disconnect the Printer Harness from the Main PCB and the Paper Advance Button.
5. Turn the Top Cover over and remove the six hex nuts securing the Printer Assembly
6. Remove the Printer Assembly
7. Install new Printer Assembly and replace hex butts and washers.
8. Connect the printer harness to the Main PCB (J6 for 3-wire printer power, J7 for printer data wire).
9. Replace Front Panel.
10. Replace Top Cover.
11. Install a roll of paper.
12. Press the Paper Advance button while applying power to the instrument to initiate a self-test. During the self-test, the display will read "ATTEMPTING TO INITIALIZE PRINTER." The printer will conduct a self -test consisting of about 20 lines of characters and 1 solid block. When the self-test is complete, the Main Menu will be displayed.
13. If the printout is unsatisfactory, for instance too light, it may be necessary to adjust the print density. The adjustment is located under the paper "tray". Remove the paper roll and remove the plug at the bottom of the tray. Insert a small flat blade screwdriver or tuning screwdriver ("tweezer") into the access hole and turn the potentiometer SLIGHTLY clockwise until the desired print density is reached. CAUTION: Excess print density can destroy the printhead!

## ***REPLACING THE PRINTER ON THE OPTOCOMP II***

1. With power applied, press the Lid Release button, and open the lid.
2. Turn the instrument off and remove the power cord from the wall receptacle.
3. Remove the Front Shroud.
4. Remove the screws from the Front Panel.
5. Disconnect the wires and cables from the Front Panel to the Main PCB.
6. Remove the Front Panel and place it face-down on a table or bench. Remove the six hex nuts holding the Printer Assembly.

7. Disconnect the Paper Feed switch from the Printer Harness.
8. Remove the Printer Assembly.
9. Install new Printer Assembly.
10. Replace hex nuts and washers.
11. Connect the Paper Feed button on the Printer Harness.
12. Connect the wires and cables from the Front Panel components to the Main PCB.
13. Replace Front Panel.
14. Replace Front Shroud
15. Restore power and run the printer self test as described above.

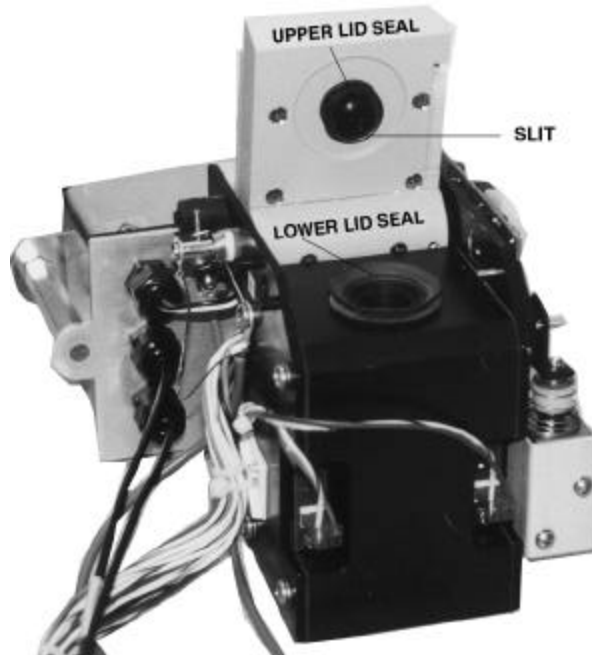
### ***REPLACING THE PRINTER IN THE OPTOCOMP IB AND IIB***

1. With power applied, press the lid release button and open the lid (OPTOCOMP II ONLY).
2. Turn off the instrument and remove the power cord from the wall receptacle.
3. Remove the two screws from the top rear of the Front Panel.
4. Hinge the Front Panel to an open position
5. Disconnect the Printer harness from the Main PCB.
6. Disconnect the Paper Advance button.
7. Remove the four hex nuts from the printer tray.
8. Remove the printer. It may be necessary to retain the paper cover or “door” from the original printer assembly. At this point remove the four screws which secure the Hinge Plates to the Paper tray and install the door on the new printer assembly.
9. Install the new printer assembly.
10. Connect the Printer Harness and Paper Advance button.
11. Close the Front Panel and replace the two screws.
12. Restore power to the instrument and test as described above.

## ***REPLACING LID SEALS-OPTOCOMP I AND IB***

### **LOWER LID SEAL**

1. With power applied, press the lid release button.
2. Gently grasp the rubber gasket of the Lower Lid Seal and lift straight up. NOTE: The Lower Lid Seal is considered to be an assembly. The black plastic ring is permanently attached.
3. Install new lower lid seal by dropping the new seal into the opening at the top of the well chamber.



### **UPPER LID SEAL**

4. With power applied, press the Lid Release button.
5. Gently grasp the rubber Upper Lid Seal and pull down gently
6. Install new seal by gently sliding it onto the black nozzle in the lid. NOTE: The upper lid seal is slit to reduce the vacuum effect on the chamber. Without the slit, the lid may not open. Make sure the slit in the new seal faces down, when the lid is open.

## **LID SEAL OPTOCOMP II**

1. With power applied, press the Lid Release button on the Front Panel and open the lid.
2. Pinch the rubber lid seal gasket between you fingers and gently lift upward. The gasket is not anchored and relies on a press fit to keep it in place.
3. Install new Lid Seal Gasket by pressing it into the channel around the cassette housing. Start from the middle of each side and work the material toward the corners to keep the material evenly distributed.



## ***REPLACING INJECTORS***

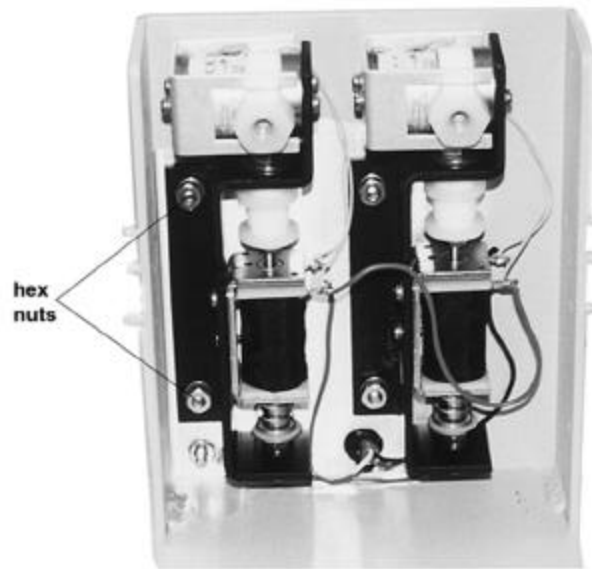
Tools required: Philips screwdriver, 11/32" wrench or nut driver, soldering iron.

### **OPTOCOMP I AND II WITH OUTBOARD INJECTORS**

1. Switch the instrument off.
2. Disconnect the Injector Cable from the rear panel of the OPTOCOMP.
3. Disconnect the output lines from the injectors.
4. Remove the four screws (two on each side) holding the front cover of the injector housing. Remove the front cover.



5. Using an 11/32" wrench or nut driver, remove the two hex nuts from the bracket of the injector to be replaced.



6. Using a soldering iron, heat the joints of the two wires on the terminals of the push pull solenoid and remove the wires from the terminals.
7. Remove the injector.
8. Place the new injector on the studs, replace the washers and hex nuts, tighten with the 11/32" wrench.
9. Solder the two wires onto the terminals of the new injector.
10. Reconnect the injector output lines.
11. Connect the injector cable to the rear of the OPTOCOMP.
12. Restore power to the OPTOCOMP.
13. From the MAIN MENU, press the INITIALIZE key.
14. Place the input lines of the injectors into a container of distilled water.
15. Place an empty test tube in the counting chamber and close the lid (for OPTOCOMP II place a full cassette of tubes at the first cassette position).
16. During the initialization of the injectors, check for leaks from the fittings, bellows etc., on the injectors.
17. If the injectors show no signs of leakage, and are working satisfactorily, replace the front cover of the injector.

## **OPTOCOMP IB**

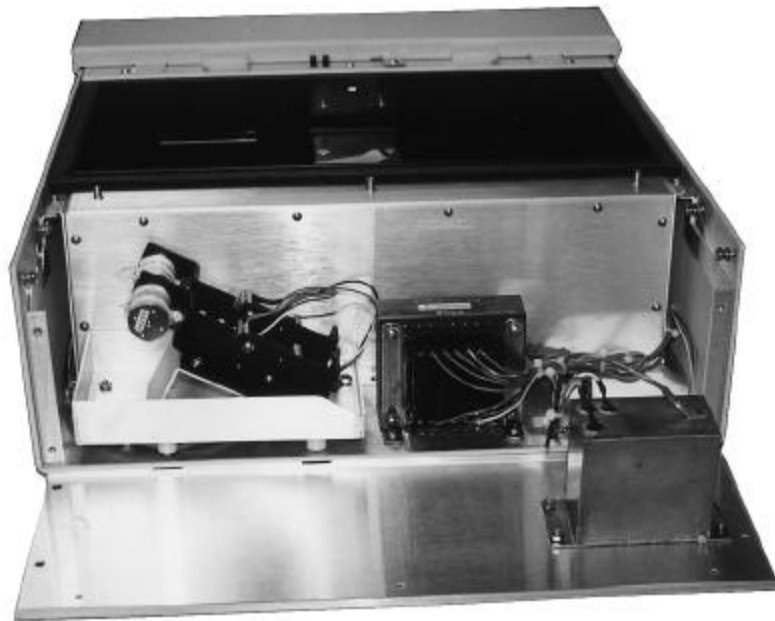
1. Switch the OPTOCOMP off and remove the power cord from the wall socket.
2. Remove the two screws from the top of the front panel, and lift the front panel to a vertical position.
3. Remove the screws securing the rear cover.
4. Remove the rear cover.
5. Disconnect the injector lines from the injector to be replaced.
6. Remove the two screws from the bracket of the injector to be replaced.

7. Using a soldering iron, heat the joints of the two wires on the terminals of the push pull solenoid and remove the wires from the terminals.
8. Remove the injector.
9. Place the new injector on the bracket and replace the two Philips head screws.
10. Solder the two wires onto the terminals of the new injector.
11. Reconnect the injector output lines.
12. Restore power to the OPTOCOMP.
13. From the MAIN MENU, press the INTITALIZE key.
14. Place the input lines of the injectors into a container of distilled water.
15. Place an empty test tube in the counting chamber and close the lid.
16. During the initialization of the injectors, check for leaks from the fittings, bellows etc., on the injectors.
17. If the injectors show no signs of leakage, and are working satisfactorily, replace the rear panel and top cover.



## **OPTOCOMP IIB**

1. Press the LID RELEASE button on the front panel, and open the lid.
2. Switch the OPTOCOMP off and remove the power cord from the wall socket.
3. Remove the two screws from the top of the front panel, and lift the front panel to a vertical position.
4. Remove the screws securing the rear panel.
5. Remove the rear panel.
6. Remove the three Philips head screws from the base of the lid.
7. Using an 11/32 socket or wrench, loosen the four hex nuts holding the rear panel from the inside (see diagram). NOTE: It is not necessary to remove these nuts, they need only to be loosened, the cover is slotted.
8. Remove the LID ASSEMBLY.



*Figure 4: Optocomp IIB with covers removed, exposing injectors*

9. Disconnect the injector lines from the injector to be replaced
10. Remove the two screws from the bracket of the injector to be replaced.
11. Using a soldering iron, heat the joints of the two wires on the terminals of the push pull solenoid and remove the wires from the terminals.
12. Remove the injector.
13. Place the new injector on the bracket and replace the two Philips head screws.
14. Solder the two wires onto the terminals of the new injector.
15. Reconnect the injector output lines.
16. Restore power to the OPTOCOMP.
17. From the MAIN MENU, press the INITIALIZE key.
18. Place the input lines of the injectors into a container of distilled water
19. Place a cassette full of empty test tubes in the counting chamber at cassette position 1.

20. During the initialization of the injectors, check for leaks from the fittings, bellows etc., on the injectors.
21. If the injectors show no signs of leakage, and are working satisfactorily, replace the lid, rear panel and front panel.

### ***REPLACING OPTOCOMP II TUBE SENSOR***

1. With power applied, press the Lid Release button and open the lid.
2. Turn the OPTOCOMP off and remove the power cord from the wall outlet.
3. Remove the Front Shroud.
4. Remove the screws from Front Panel.
5. Disconnect the wires and cables from the Front Panel to the Main PCB and remove the Front Panel.
6. Disconnect the Lid Release Solenoid from the Main Harness.
7. Remove the 8 screws from the Upper Light Shield and remove the Upper Light Shield.



*Figure 5: Optocomp II tube sensor*

8. Locate the Tube Present Sensor along the inside wall of the cassette housing.
9. Remove the two screws from the Tube Sensor Assembly
10. Disconnect Tube Present Sensor.
11. Check the replacement Tube Sensor for binding etc. and install if the plunger moves satisfactorily.
12. Replace Upper Light Shield.
13. Connect the Lid Release Solenoid.
14. Connect the Lid Sensor on Front Panel as well as the keyboard, printer and display, and install Front Panel. NOTE: Turn the power on at this point and press the Lid Release button to check that the Lid Release Mechanism works properly.
15. Replace Front Panel screws.
16. Replace Front Shroud.

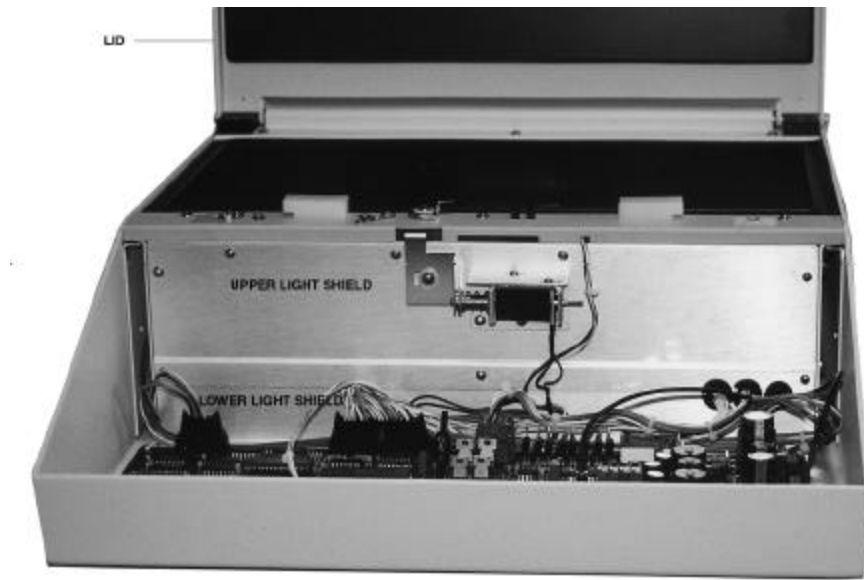
## ***REPLACING OPTOCOMP IIB TUBE SENSOR***

1. With power applied, press the lid release button and open the lid.
2. Turn the power off and remove the power cord from the wall outlet.
3. Remove the two screws from the top of the Front Panel.
4. Rotate the Front Panel to the open position.
5. Disconnect the Lid Release Solenoid from the Main Harness.
6. Remove the 8 screws from the Upper Light Shield and remove the Upper Light Shield.
7. Locate the Tube Present Sensor along the inside wall of the cassette housing.
8. Remove the two screws from the Tube Sensor Assembly.
9. Disconnect Tube Present Sensor.
10. Check the replacement Tube Sensor for binding etc. and install if the plunger moves satisfactorily.
11. Replace Upper Light Shield.
12. Connect the Lid Release Solenoid.
13. Connect the Lid Sensor on Front Panel. NOTE: Turn the power on at this point and press the Lid Release button to check that the Lid Release Mechanism works properly.
14. Close the front panel, and replace the two screws to the top of the front panel.

## ***REPLACING OPTOCOMP II CASSETTE DRIVES***

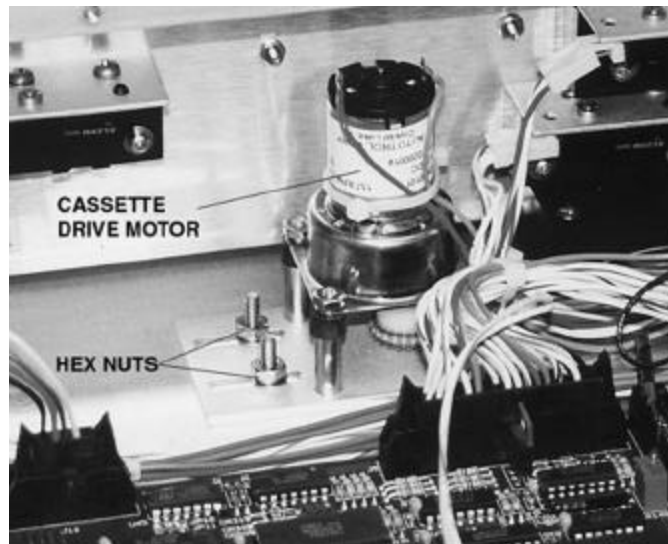
### **FRONT CASSETTE DRIVE**

1. With power applied, press the Lid Release button and open the lid.
2. Remove the Cassettes from the right side of the Cassette Housing.
3. Turn the OPTOCOMP off and remove the power cord from the wall outlet.
4. Remove Front Shroud.
5. Remove Front Panel.
6. Remove Upper Light Shield.
7. Remove Lower Light Shield.

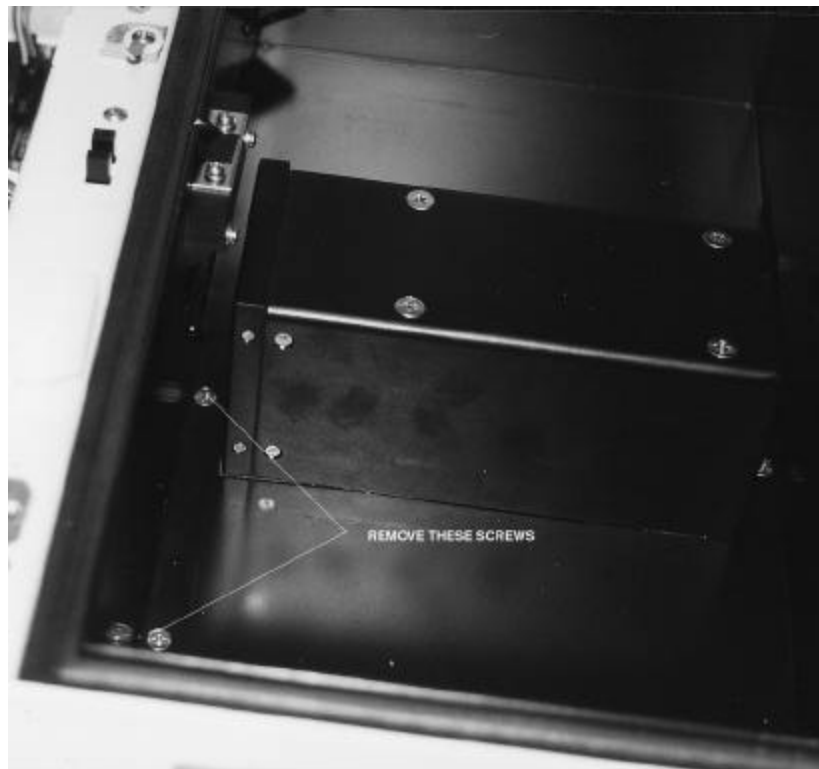


*Figure 6: Optocomp II, front view, front panel removed*

8. Loosen the two hex nuts on the Cassette Drive Motor Bracket and rotate the bracket to provide slack in the drive belt.



9. Remove the two flat head screws from the right front of the Cassette Housing. NOTE: It may be necessary to remove the PMT to gain access to the center-most screw. The nozzle block should not be removed due to the fact that the aim of the injector lines is critical.



10. Disconnect the Tab Sensor PCB from the Main Harness.

11. Remove the Cassette Drive Mechanism.
12. Check the replacement Cassette Drive Mechanism for freedom of travel etc., connect the Tab Sensor PCBs, and install if satisfactory.
13. Replace the two flat head screws in the cassette housing.
14. Check the Drive Belt for proper position of the sprockets.
15. Pull the Drive Motor Bracket to remove any slack in the belt, and tighten the two hex nuts on the Motor Bracket.
16. Reconnect the Front Panel at this point and restore power to the instrument.
17. From the Main Menu, press Utilities, 4 Enter, to access the Cassette Motion Utility.
18. Press 0 to initialize the cassette drives. Check to ensure that the tabs on the front drive are “parked” and not exposed in the cassette housing.
19. From the Main Menu, press 1, ENTER to cycle cassettes and 0, ENTER for Front Cassette first to check the operation of the new cassette drive mechanism. If the drive is satisfactory, turn the power off and disconnect the power cord from the wall outlet once again.
20. Replace the upper and lower light shields.
21. Reconnect the Lid Sensor, Display, Keyboard, and Printer, and install front panel. Verify that the lid release mechanism works properly by either manually rotating the lid release, or applying power and pressing the Lid Release button.
22. Replace Front Panel Screws.
23. Replace the Front Shroud.

## **REAR CASSETTE DRIVE**

1. With power applied, press the Lid Release button and open the lid.
2. Remove the Cassettes from the left side of the Cassette Housing.
3. Turn the OPTOCOMP off and remove the power cord from the wall outlet.
4. Remove the three screws from the lid at the rear of the Cassette Housing.
5. Remove the 6 screws holding the rear panel and remove the Rear Panel.
6. Remove the Lid Assembly by loosening the four hex nuts on the inside of the rear of the instrument, and lifting straight up.
7. Remove the rear light shield.
8. Remove the two flat head screws from the left rear of the Cassette Housing.
9. Loosen the two hex nuts holding the rear Cassette Motor Bracket.
10. Remove the Cassette Drive Assembly and disconnect the Tab Sensor PCBs from the Main Harness.
11. Check the replacement Cassette Drive Mechanism for freedom of travel etc. and install if satisfactory, connect the Tab Sensor PCBs to the Main Harness.
12. Replace the two flat head screws in the cassette housing.
13. Check the Drive Belt for proper position on the sprockets.
14. Pull the Drive Motor Bracket to remove any slack in the belt, and tighten the two hex nuts on the Motor Bracket.
15. Restore power to the instrument.
16. From the Main Menu, press Utilities, 4 Enter, to access the Cassette Motion Utility.

17. Press 0 to initialize the cassette drives. Check to ensure that the tabs on both drives are “parked” and not exposed in the cassette housing.
18. From the Main Menu, press 1, ENTER to cycle cassettes and 1, ENTER for Rear Cassette first to check the operation of the new cassette drive mechanism. If the drive is satisfactory, turn the power off and disconnect the power cord from the wall outlet once again.
19. Replace the Lid Assembly, the 3 screws at the rear of the Cassette Housing, and tighten the four hex nuts on the inside of the instrument.
20. Replace the Rear Panel.

### ***OPTOCOMP IIB FRONT CASSETTE DRIVE***

1. With power applied, press the Lid Release button and open the lid.
2. Turn power off and remove the power cord from the wall outlet.
3. Remove the two screws from the top of the Front Panel and lift the panel to a vertical or open position.
4. Remove Upper Light Shield. (See OPTOCOMP II)
5. Remove Lower Light Shield.
6. Loosen the two hex nuts on the Cassette Drive Motor Bracket and rotate the bracket to provide slack in the drive belt.
7. Remove the two flat head screws from the right front of the Cassette Housing.
8. Disconnect the Tab Sensor PCB from the Main Harness.
9. Remove the Cassette Drive Mechanism.
10. Check the replacement Cassette Drive Mechanism for freedom of travel etc., connect the Tab Sensor PCBs, and install if satisfactory.
11. Replace the two flat head screws in the cassette housing.
12. Check the Drive Belt for proper position on the sprockets.
13. Pull the Drive Motor Bracket to remove any slack in the belt, and tighten the two hex nuts on the Motor Bracket.
14. Reconnect the Front Panel at this point and restore power to the instrument.
15. From the Main Menu, press Utilities, 4 Enter, to access the Cassette Motion Utility.
16. Press 0 to initialize the cassette drives. Check to ensure that the tabs on the front drive are “parked” and not exposed in the cassette housing.
17. From the Main Menu, press 1, ENTER to cycle cassettes and 0, ENTER for Front Cassette first to check the operation of the new cassette drive mechanism. If the drive is satisfactory, turn the power off and disconnect the power cord from the wall outlet once again.
18. Replace the upper and lower light shields.
19. Close the front panel and replace the two screws at the top of the front panel.

Follow the instructions above for the removal and replacement of the rear cassette drive

## ***OPTOCOMP™ RECOMMENDED SPARE PARTS***

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### ***OPTOCOMP I Parts***

<b><u>MGM Part Number</u></b>	<b><u>Description</u></b>
0110-3023-00	Well Reflector
0112-0004-00	Well Liner Assembly
0112-0005-00	Lid Seal-Lower
0200-0012-00	Lid Seal-Upper
0200-0005-00	Lid Spring
0330-3750-01	Fuse 3/8 Amp Slo-Blo
0112-5220-40	Injector Line-Input (Red)
0112-5220-30	Injector Line-Input (Blue)
0112-5230-40	Injector Line-Dispense (Red)
0112-5230-30	Injector Line-Dispense (Blue)
6110-0008-00	Shutter Sensor
0112-3111-20	Shutter Rack Assembly
0112-0106-00	Shutter Motor Assembly (Autotrol)
0112-0111-00	Lid Release Solenoid
0111-3001-02	Lid Catch
0111-3006-00	Tube Platform
0200-0010-00	Tube Spring
0200-0011-00	Well Liner
8000-0000-00	Operator's Manual

### ***OPTOCOMP II Parts***

<b><u>MGM Part Number</u></b>	<b><u>Description</u></b>
011-4018-05	Cassette
0110-4016-00	Lid Gasket
0112-0120-00	Tube Sensor Assembly
0112-0010-00	Cassette Drive Mechanism
0112-4200-00	Cassette Drive Motor Assembly
0200-0032-00	Lid Release Solenoid
0200-0022-00	Cassette Drive Belt
6110-0005-00	Shutter Sensor
0700-0014-01	Tab Sensor Assembly
0700-0014-02	Tab Sensor Assembly (LED)
0112-5220-10	Injector Line-Input (Blue)
0112-5220-20	Injector Line-Input (Red)
0112-5230-10	Injector Line-Dispense (Blue)
0112-5220-20	Injector Line Dispense (Red)
0300-0057-00	Fuse 1/2Amp Slo-Blo
0200-0300-00	Cassette Extraction Tool



**MGM Part Number**

**Description**

6110-0006-00	Lid Sensor
0112-0132-00	Shutter Rack Assembly
0110-4029-00	Shutter Cover ¼ inch
0110-4018-00	Shutter Cover ½ inch
0110-4131-01	Lid Latch Plate
0112-0131-00	Shutter Motor Assembly (Autotrol)
0112-0146-00	Shutter Motor Assembly (Mireo Mo)
0800-0001-00	Operator's Manual

***OPTOCOMP I and II Common Parts***

**MGM Part Number**

**Description**

0700-0017-00	Keyboard Assembly
9100-0004-00	Keyboard Overlay
0700-0011-00	Main PC Board Assembly
0112-0115-00	Pre-Amp Board Assembly
0112-3113-00	Photomultiplier Tube
0112-0001-00	Printer Assembly
0112-0002-00	LCD Display
0112-0142-00	Main transformer Assembly
0112-0003-00	Push Button Assembly (lid Release and Paper Advance)
0300-0016-00	Power Entry Module
0300-0068-00	Line Cord
9000-0004-00	Thermal Printer Paper
0111-3015-00	Paper Spool
0200-0018-00	Foot
9100-0004-00	Keypad Overlay

***INJECTOR SPARE PARTS***

**MGM Part Number**

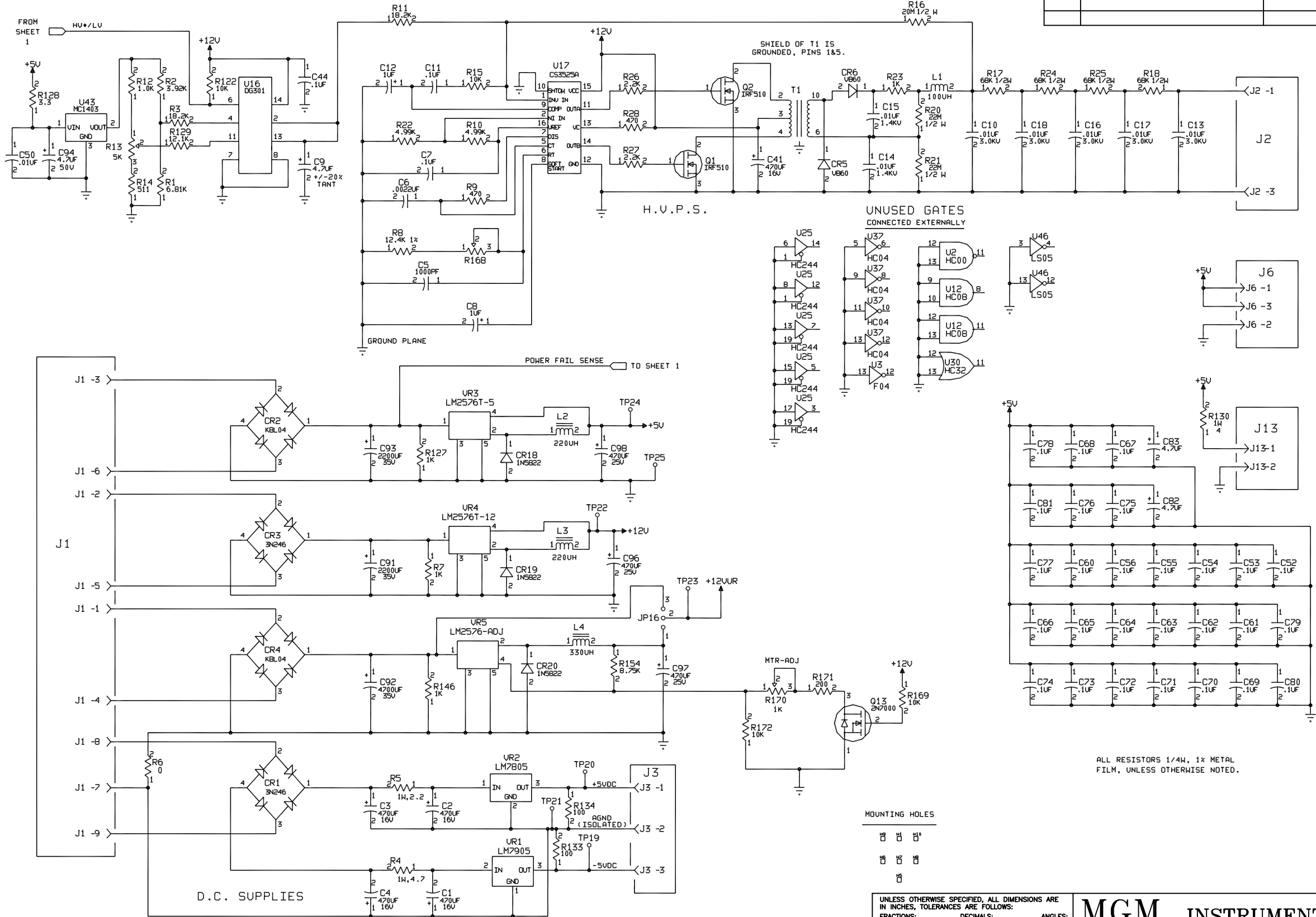
**Description**

0112-0006-00	Bellows Assembly
0112-0147-00	Solenoid Assembly
0112-0007-00	Injector Pump Assembly 200-300uL
0112-0007-01	Injector Pump Assembly 50-199uL
0200-0037-00	Valve Fitting-Red
0200-0038-00	Valve Fitting Blue
0112-0143-00	Plunger
0200-0049-01	Solenoid Valve (200+uL)
0200-0049-02	Solenoid Valve (100uL)





REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RELEASED PER ECN 102535	5.8.95	
A-1	RELEASED PER ECN 102542		
G-3	RELEASED PER ECN 102879		

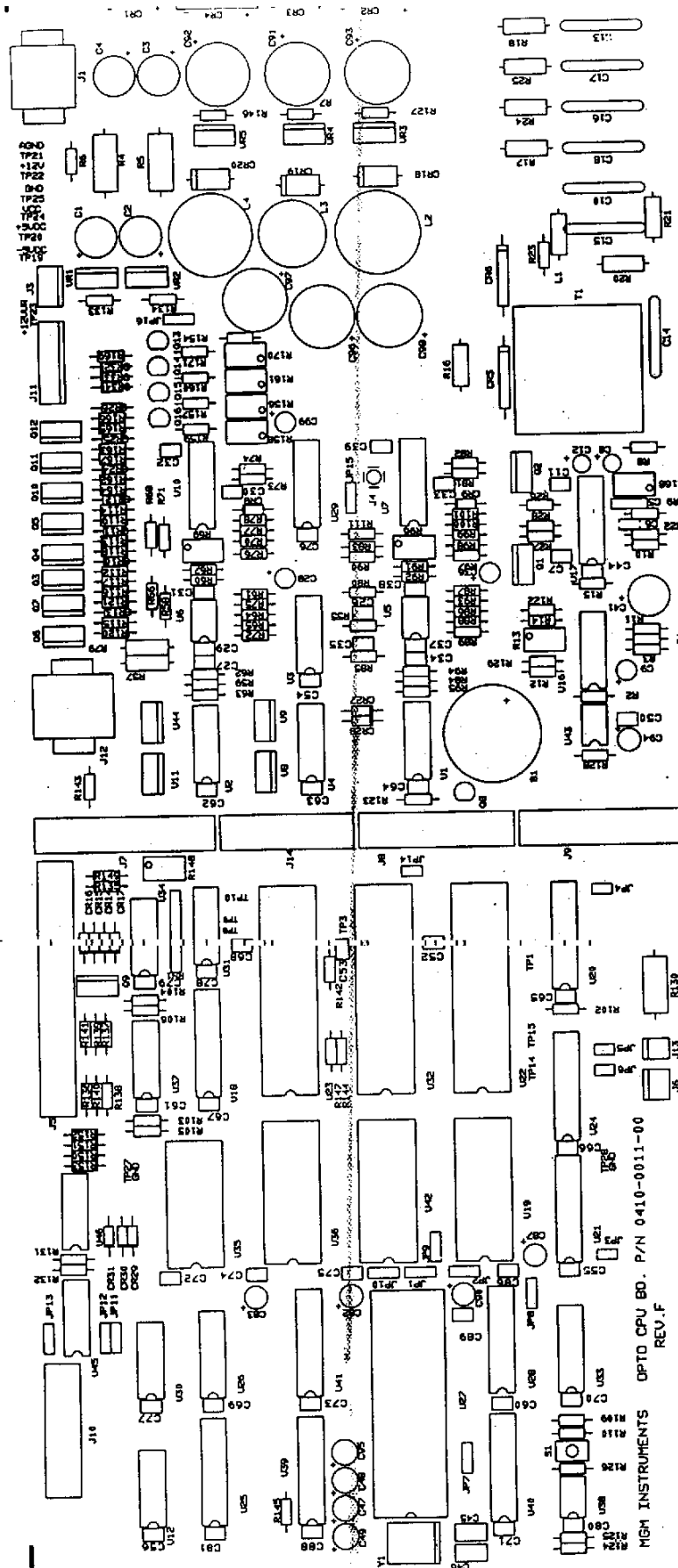


ALL RESISTORS 1/4W, 1% METAL FILM, UNLESS OTHERWISE NOTED.

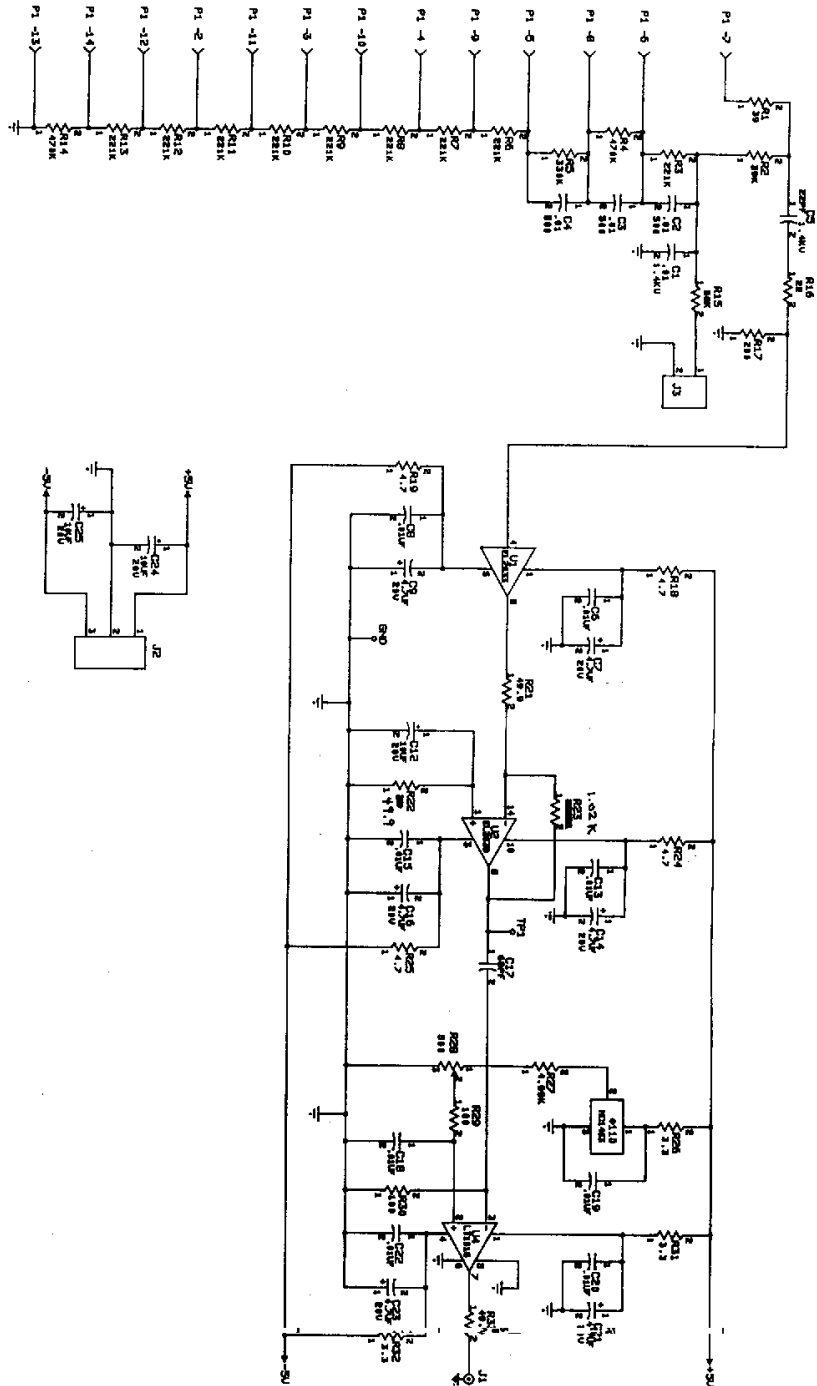
MOUNTING HOLES  
Ø 1/8"  
Ø 1/4"  
Ø 3/8"

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES. TOLERANCES ARE AS FOLLOWS: FRACTIONS: ±1/32"    DECIMALS: .xxx=±.005"    ANGLES: ±1°			
MATERIAL:	DATE: NOV 28 2000	APPROVED:	DESIGNED BY: BZ
	SCALE:		DRAWN BY: ZM
FINISH:	PART NAME/TITLE MAIN PCBOARD		REVISION: G-3
SPECIAL NOTE:	APPLICATION: OPTOCOMP	DRAWING NUMBER: 0700-0011-00	SHEET: 3 of 4





COMPANY: MGM INSTRUMENTS  
 REV. F: 3-5-93  
 PALDEN DESIGN SERVICES: WARDEN, CT 06514 203-291-4198



	0700-0012-00
	OFTOCOMM PLE-AUP
	P.C.B. - SCHEMATIC
D	REV. E